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AMERICAN STATISTICAL ASSOCIATION

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DECEMBER 1954
Volume 8, No. 5

35 CENTS

OPINIONS ON STATISTICAL STANDARDS

The American Statistician for June–July printed the report of the Ad Hoc Committee on Statistical Standards appointed to advise the Board of Directors as to whether the ASA should undertake to develop a set of standards, both technical and ethical, for the guidance of the statistical profession. With the acceptance of its report this committee, which was headed by Rensis Likert, has been discharged, and the next step is to determine whether there is substantial interest among our membership. Herbert Marshall, President of the Association, has appointed an Ad Hoc Committee to Explore Opinion on Standards of which William W. K. Freeman, Mutual Boiler and Machinery Insurance Company, Boston, Massachusetts, is chairman.

A preliminary survey of the opinion of the members of the Boston Chapter was undertaken in August so that members of the Board might have some idea on the reception of this report in time for the annual meeting at Montreal. Although Dr. Likert's committee recommended starting with the less controversial subject of technical standards, the Boston Chapter sought opinions on developing a code of ethics because of the moves already made in this area in 1951.

The questionnaire referred briefly to the report of Dr. Likert's committee and went on to say:

"The basic recommendations of the committee were

1. That a thorough and continuing piece of work be done, or none at all.
2. That the work should be undertaken only if there was substantial interest of members.

Hence the enclosed return postcard. Will you be so kind as to return it this week, because the time is so short?"

The return postcard read as follows:

On the question "Should the American Statistical Association undertake a study to codify the ethics of statisticians?"

__ I favor strongly
__ I favor mildly
__ I am uncertain
__ I oppose mildly
__ I oppose strongly

Date: _____

Signature (Optional)

The results as of September 16th, one month later, were as shown in table 1.

TABLE 1

Over-all Result

	No. of Replies	
Favor strongly	38	40%
Favor mildly	25	26
Uncertain	14	15
Oppose mildly	12	13
Oppose strongly	6	6
Total in favor	63	66%
Uncertain or opposed	32	34
Total replies	95	100%

95 Respondents are 60% of 157 total in Boston Chapter.

To interpret the results, it is necessary to describe briefly the method used in this survey. A letter and card were sent to all members of the Association in the territory of the Boston Chapter, regardless of whether or not they made contributions to the Chapter. Those that answered without any follow-up are referred to as Sample A. A random sample was selected 10 days later than the original letter and this is called Sample B, consisting of 30 out of the approximately 100 non-respondents. Those in the vicinity were reached by telephone, while those who were on vacation or at a distance for other reasons were followed-up by mail. Replies were received from 20 out of 30. An analysis of the reasons for not getting a reply shows—

Away from Office	10
Put aside	3
Unknown	7
	20

Ignoring Sample C (two follow-ups, not a random sample) a comparison of Sample A (no follow-up) and of Sample B (followed up) shows an interesting difference in the fact that those in favor who replied without follow-up were in the ratio of 1.8:1 (including the "uncertain" with the "opposed") while the ratio was 3:1 among those who were followed up (table 2).

TABLE 2

Comparison of Samples A and B

	Sample A No Follow-up		Sample B With Follow-up	
Favor strongly	27	37%	10	50%
Favor mildly	20	28	5	25
Uncertain	12	16	1	5
Oppose mildly	8	11	4	20
Oppose strongly	6	8	0	0
Total in favor	47	64%	15	75%
Uncertain or opposed	26	36	5	25
Total Sample A and B	73	100%	20	100%

Two opposite interpretations may be placed on this difference:

a. In a telephone conversation, a more favorable rather than a less favorable reply might tend to be given in some cases, even though the questioner tried to appear completely neutral; this would throw a complete census more towards Sample A than Sample B.

b. Those who were strongly opposed answered immediately, which would throw a complete census towards Sample B.

Although signatures were optional, all but 6 cards were signed: 5 in favor as against one in mild opposition.

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The Editorial Committee welcomes the submission of manuscripts for possible publication. Two copies, double-spaced, should be sent to the Editor, Almarin Phillips, E-140 Dietrich Hall, University of Pennsylvania, Philadelphia 4.

News and notes should be sent to Dana Barbour, News Editor, American Statistical Association, 1108 16th Street, N.W., Washington 6, D. C.

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NEWS

NSF Grants—Meetings—Training Program at North Carolina

Grants for Attendance at International Meetings

The National Science Foundation will award individual grants to defray partial travel expenses of a limited number of scientists who will attend the International Symposium of the Biometric Society, to be held at Campinas, near Sao Paulo, Brazil, July 4–8, 1955, or the Twenty-ninth Session of the International Statistical Institute to be held in Rio de Janeiro, Brazil, June 24–July 2, 1955. Application blanks for grants may be obtained from the National Science Foundation, Washington 25, D. C. Completed applications must be returned to the Foundation by December 31, 1954, in order to permit time for evaluation and processing.

Meeting of the Society for Industrial and Applied Mathematics

The Society for Industrial and Applied Mathematics will hold its first national meeting in conjunction with the annual meetings of the American Mathematical Society, the Mathematical Association of America, and the Association for Symbolic Logic at the University of Pittsburgh, on December 27–29. The following addresses will be presented to an evening meeting: "The History of a Problem", Dr. Brockway McMillan, Bell Telephone Laboratories; "The Control of Industrial Operations", Prof. Herbert A. Simon, Carnegie Institute of Technology; "Probability Theory in Liability and Property Insurance", Mr. C. W. Crouse, Actuary, Preslan and Company. Further information can be obtained from H. W. Kuhn, Dalton Hall, Bryn Mawr College, Bryn Mawr, Pa.

North Carolina Training Program for Research Workers

The Institute of Statistics at North Carolina State College is sponsoring a nine day intensive training program in Statistical Methods for Research Workers in Industry and the Physical Sciences starting January 22, 1955 and running daily (including Sundays) through January 30, 1955. The course is designed to make available to research workers in industry and the physical sciences the new and powerful statistical techniques of data analysis and experimental design. Guest lecturers will include W. J. Youden, Statistical Engineering Laboratory, National Bureau of Standards; Carl A. Bennett, Hanford Works, General Electric Company; and Cuthbert Daniel, Statistical Consultant, New York City.

A registration fee of $100.00 will be charged and enrollment will be limited to the first fifty qualified applicants. For further information write to Institute of Statistics, North Carolina State College, Box 5457, Raleigh, North Carolina.

Survey of Research in Progress on the Middle East

The Middle East Institute is preparing for publication an annual Survey of Research in Progress on the Middle East.

Geographical limits: the Arab countries, Israel, Turkey, Iran, Afghanistan, North Africa, the Sudan, Ethiopia and Eritrea.

Disciplinary limits: the social sciences and appropriate aspects of related fields (e.g., linguistics, archaeology, art, law and Islamics).

Chronological limits: none (ancient, medieval and modern).

All those currently engaged in research on the Middle East are urged to submit the following information: name, address, topic of investigation, sponsoring organization (if any), estimated date of completion, and pertinent comment on the nature of the research, sources being used, and method of approach.

Please address correspondence to: Survey of Research
The Middle East Institute
1761 N Street, N. W., Washington 6, D. C.

Conference on Measurement and Behavior of Unemployment

A Conference on the Measurement and Behavior of Unemployment was held in Princeton on September 17–18, attended by about 90 invited experts in the field. The Conference was sponsored by the Universities-National Bureau Committee for Economic Research, and was planned and arranged by a committee consisting of Ross Eckler, Bureau of the Census; Richard Lester, Princeton University; Lloyd Reynolds, Yale University; Charles Stewart, Bureau of Labor Statistics; and Clarence D. Long (chairman), Council of Economic Advisers. The committee was assisted by E. J. Eberling, Vanderbilt University; and Meredith B. Givens, Division of Employment, New York State Department of Labor.

The Conference was organized to study concepts and operational techniques used in measuring unemployment and to analyze in detail the structure and behavior of unemployment in this country and abroad. Participants included representatives from 28 universities, the Dominion Bureau of Statistics, and a number of Federal agencies—the Bureau of the Census, Agricultural Marketing Service, Budget Bureau, Bureau of Employment Security, Bureau of Labor Statistics, Council of Economic Advisers, Department of Defense, Federal Reserve, Library of Congress, and Office of Defense Mobilization. In addition to the National Bureau of Economic Research, a number of other research organizations and business and labor groups were represented.

Continued on page 22

FEDERAL STATISTICAL ACTIVITIES

National Science Foundation Surveys of Scientific Research and Development

The responsibilities of the Federal Government toward science have changed greatly during the past half century, as pointed out by the President in connection with the issuance of a recent Executive Order dealing with the activities of the National Science Foundation. The fact that the Federal Government supplies more than 50 percent of all the investment for scientific research and development in the nation today is evidence of the important role of science in our national affairs. Since most of the Federal funds for research and development are transferred to industrial establishments and educational institutions, Federal policies and practices regarding research and development are felt immediately and substantially by these firms and institutions.

In order to obtain basic factual information for the formulation of national policies in support of research and education in the sciences, the National Science Foundation is making coordinated surveys of the research activities in three broad sectors of the economy: government, universities, and industry.

The surveys of government agencies and of institutions of higher learning are being conducted by the Foundation's own staff. In the area of industrial research and development, arrangements have been made for the following surveys to be conducted for the Foundation:

1. A survey of manufacturing and nonmanufacturing industries, by the Bureau of Labor Statistics. This survey will consist of two phases: mailing of questionnaires to a sample of approximately 12,000 companies, and interviews with company representatives of approximately 200 selected large corporations. The sampling frame was developed from the company file of the Bureau of Old-Age and Survivors Insurance. Included in the survey will be all companies employing 1,000 employees or more, and a sample of smaller companies drawn with probabilities varying according to the particular industry's estimated "research propensity" (by 2-digit SIC groups), and the size (in terms of employment) of the particular company.

2. A survey of commercial research laboratories and nonprofit research institutes other than those directly connected with a university, by Syracuse University. An intensive questionnaire will be sent to a list of the 300 largest (in terms of employment) commercial laboratories. The remaining part of the universe, estimated to number 6,000, will receive a short questionnaire. The sampling frame has been developed by consolidating already existing lists (such as the National Research Council directory of commercial laboratories), supplemented by addresses from classified telephone directories for a special-purpose, stratified sample of cities with 25,000 inhabitants or more.

3. A survey of trade associations, similar cooperative industrial research organizations, professional societies and associations, and labor unions, by Battelle Memorial Institute. A postcard type of survey will be used to establish the universe of study by discarding from existing lists respondents who are not engaged in research; in addition, this preliminary inquiry, directed to approximately 5,500 organizations, will attempt to obtain answers to a few simple questions concerning research activity. An intensive questionnaire will then be sent to all of those having performed research in excess of $15,000 in 1953. The estimated size of this group is 300 to 400. Finally, personal interviews will be conducted with officials of approximately 35 selected organizations which, according to their response to the questionnaire, have been performing a considerable amount of research over the past years. A small group of organizations which, though not supporting research, might have been expected to do so because of the characteristics of the affiliated industry, will also be interviewed.

The several surveys have been carefully coordinated to provide comparable information in considerable detail on research and development expenditures and cost, and on technical manpower. Among the expected results of the surveys will be the preparation of estimates, for the first time on a nation-wide basis, of sources and uses of research funds by major economic sectors. The findings should also be helpful in ascertaining and appraising patterns of research activity as reflected in the operations of the commodities and service producing industries (e.g., manufactures, communications, transportation), of the specialized producers of industrial research (e.g., research institutes, commercial laboratories), and of various intermediate and cooperative groups (e.g., trade associations). The interviews will include information on industry's opinion with respect to policies to strengthen the country's scientific research effort, on specific bottlenecks enconutered by industry in its own research planning, and on the economic payoff of research. Finally, an attempt will be made to reconstruct from historical information the growth pattern of industrial research. This should be of considerable help in estimating research manpower and capital requirements that are likely to confront the nation's economy as that economy expands in the future.

J. E. Morton,
National Science Foundation

Plans for Revision of Standard Industrial Classification

The United States Standard Industrial Classification is in process of a comprehensive review. The last major revision of the SIC for manufacturing industries was made in 1945, and for nonmanufacturing industries in 1949. The present review is being undertaken primarily at the request of industry groups, to take into account significant technological and structural changes which have occurred since that time.

INDUSTRY REVIEW

Two years ago, through its business Advisory Council on Federal Reports, the Budget Bureau initiated formal procedures for industry review of the SIC. A Coordinating Committee on the Revision of the Standard Industrial Classification was established by the Council under the chairmanship of P. K. Lawrence of the du Pont Company, with a separate subcommittee for coordinating the recommendations concerning manufacturing industries, under the chairmanship of Horace Stringfield of U. S. Steel.

Separate committees, with a total membership of over 300 industry representatives, were established to review the SIC in terms of significant changes within their industrial areas, to insure that important new industrial processes are identified in statistical tabulations based on the Classification. Each of these committees was asked to examine all industries, accompanying definitions, and other descriptive statements in a specific division or major group of the SIC, and to submit recommendations which would improve the sta-

tistics resulting from application of the Classification. The committees were also requested to examine other parts of the SIC in which they had interests to suggest improvements for the consideration of the other industry committees reviewing the Classification.

Most of the industry committees have completed their review and submitted their recommendations to the industry Coordinating Committee which, after review and approval, transmits the recommendations for each group to the Bureau of the Budget. It is expected that all industry recommendations will be transmitted to the Bureau by December 1.

GOVERNMENT REVIEW

Within the Government, all industry recommendations for changes in the SIC are reviewed by the interagency Technical Committee on Standard Industrial Classification. This committee, under the chairmanship of V. S. Kolesnikoff of the Budget Bureau, represents the Federal agencies most directly concerned with the application and use of the SIC—the Bureau of the Census, Bureau of Employment Security, Bureau of Labor Statistics, Business and Defense Services Administration, Federal Reserve Board, Government Patents Board, Small Business Administration and Social Security Administration. In its systematic examination of each industry recommendation for change, the Technical Committee also considers comments from labor and research organizations, availability of data, continuity of statistical series, and other pertinent information.

As a guide for the Committee in reaching its decisions, a special subcommittee developed "Criteria for Recognizing an Industry," including such factors as economic significance, homogeneity, primary product dispersion, coverage, stability of establishment classifications, and continuity of data. The subcommittee also prepared special tabulations of data for the 400 industries included in the 1947 Census of Manufactures as an aid to the Technical Committee in applying these criteria.

When the Technical Committee has completed its examination of a given major group, it discusses with the industry committee concerned any questions which have arisen needing clarification or supplementation, or regarding differences of opinion. It is expected that provisional decisions on changes in the SIC will be tested, wherever possible, by special tabulations of data collected in the 1954 economic censuses, and that these test runs will be available by January 1956.

TIMETABLE FOR REVISION

It is planned that the revised SIC should go into effect for all agencies on January 1, 1958. This date will allow for introduction of the revised classification simultaneously in current surveys and tabulations and in the 1958 Censuses of Business, Manufactures and Mineral Industries.

The following timetable has been adopted by the Technical Committee in order to meet this date:

July 1, 1954 to June 1, 1956—Review of all proposed changes by the Technical Committee, as described above, and approval of changes by the Office of Statistical Standards, Bureau of the Budget.

July 1, 1956—Mimeographed copy of the revised SIC (including Alphabetic Indexes as well as Titles and Descriptions) to be completed.

February 1, 1957—Preparation of the manuscript for the printer to be completed. The printed SIC manual will have four parts:

Part 1. Manufacturing Industries (Titles and Descriptions)

Part 2. Manufacturing Industries (Alphabetic Index)

Part 3. Nonmanufacturing Industries (Titles and Descriptions)

Part 4. Nonmanufacturing Industries (Alphabetic Index)

June 1, 1957—Revised SIC manual to be available for distribution and put on sale by the Superintendent of Documents. Manual to be issued by the Bureau of the Budget, with a statement that the revised classification shall go into effect on January 1, 1958.

This will be the first time in connection with a revision of the classification that Federal statistical agencies will be given sufficient time to adjust their data, prepare their own adaptations of the classification manuals, and work out necessary administrative procedures for refiling their records. The present timetable will make the revised document available, at least in mimeographed form, by July 1956, for use by the agencies affected in planning their programs for fiscal year 1958 when the revised classification becomes effective.

V. S. KOLESNIKOFF,
Office of Statistical Standards,
Bureau of the Budget

Report of Special Advisory Committee on Employment Statistics

The Special Advisory Committee on Employment Statistics has recently completed its investigation and submitted its final report to the Secretary of Commerce. The committee was appointed by the Secretary of Commerce in February 1954 to inquire into the reasons for the differences between the estimates of unemployment from the old 68-area sample design used for the Current Population Survey since 1943 and the new 230-area design introduced in January 1954. The committee was also charged with a reexamination and evaluation of the methods used by the Bureau of the Census in the monthly survey. Members of the committee were: Frederick F. Stephan (chairman), Princeton University; Lester R. Frankel, Alfred Politz Research, Inc.; and Lazare Teper, International Ladies' Garment Workers Union.

The committee's report includes a discussion of the task of the committee, a description of the operations of the monthly Current Population Survey, a summary of general conclusions, and a more detailed section on the committee's findings. The findings are discussed under the headings of: Similarities and differences between the old and the new surveys; comparative accuracy of the two surveys; adequacy of the sample size; questionnaire and interview; control and quality check; editing, coding, and tabulation processes; estimating procedure; adjustment and use of past series; work load; and recommendations for study by a continuing committee.

Following is the committee's "Summary of General Conclusions":

"A number of particular conclusions and recommendations are presented in the next section 'Committee Findings' in connection with the topics to which they apply. The following general conclusions emerge from our inquiries:

"1. The discrepancy between the estimates derived from the old and new sample for January appears to have been due primarily to operating difficulties brought about by the transition and is therefore of a temporary nature. Nevertheless, it focussed attention on the fact that there are serious weaknesses in the labor force survey due to the inherent difficulty of some of the classifications that are attempted, the nature of the extended field operations that are necessary to cover the whole country, the limitations of funds and personnel available for the work, the unresolved technical

problems that await research, and a variety of problems connected with interviewing.

"2. The discrepancy was reduced substantially in the survey for February and there was no evidence to justify an alteration of the plans previously made for completing the transition from the 68 area sample to the new 230 area sample. No fundamental flaws were discovered in the new sample design or in the operating procedures of the new survey.

"3. The Committee is of the opinion that the 230 area sample is an advance over the old design based on 68 areas and that it reflects changes in the labor force in a more sensitive manner than heretofore. However, the Committee feels that the new design needs to be strengthened further both through a further increase in the number of areas in the sample design and the use of a substantially larger number of households. At the same time, the Committee strongly urges that the use of controls and quality checks at all stages of enumeration be developed to the point where the essential accuracy of the information is assured.

"4. The Committee believes that the old and the new sample data can be utilized as a consecutive series through a number of adjustment steps, the first of which has already been undertaken by the Census when it released its preliminary data for unemployment levels in connection with the March labor force statistics. This work needs to be continued in order to extend and refine these adjustments.

"5. Measures of the accuracy of the labor force data should be coupled more prominently with the monthly estimates both in the releases to the press as well as in the more detailed final reports. They should include appropriate allowances for all the factors which bear on it. Tables of sampling errors have been published in the past but they should be extended to take account not only of the factors due to sampling but to all other major causes of inaccuracy as well. It should be made clear to the public that all measurement in this and many similar areas is approximate and that the determination of the accuracy to be attained is governed both by the needs for precision and by the amounts of funds that can be devoted to the survey.

"6. Field procedures now in use need to be strengthened to achieve better performance and control of the processes of obtaining labor force information from the households in the sample. Specifically, there is need for closer contacts between supervisors and the interviewers working under them, furthe development of supervisory techniques and practices, the perfection of adequate control checks and qualitative evaluations of the work of individual interviewers as well as of summary results, research into the prevalent causes of errors throughout the survey operation, and development of more realistic performance standards for the work. Moreover, there is need to correct some of the adverse effects brought about by mechanization of operations and to discover still better ways for conducting routine processes of recording and tabulating of data obtained in the course of the field work. Careful attention should be given to the work load assigned to the interviewers, to their rate of pay, to recognition of superior performance and to a number of other aspects of field work which are important in the maintenance of high standards.

"7. The Committee believes that the composite estimating procedure which has been introduced in the new sample has considerable merit and is apt to improve the accuracy of measurement for a number of labor force categories though unfortunately not for the estimates of unemployment at the present time. The Committee also believes that there are some potential hazards in this as well as alternative estimating procedures which should be investigated thoroughly. Until adequate safeguards can be developed to protect against them, the estimating procedure should be regarded as experimental, and appropriate cautions should be included in the publications in which the estimates are released. Special attention should be given to the investigation of the differences between the results of the interviews with households which have just been introduced into the labor force sample and those obtained from the households which have been covered by the sample in the previous months, since these differences are the principal sources of uncertainty about the accuracy of the new procedure and also of alternative procedures.

"8. The concepts of unemployment and other labor force categories that are used as the basis for the monthly surveys are in need of a general overhauling. They were developed, for the most part, during the depression years of the thirties and were at the time a very substantial improvement over the previously-utilized concepts. Nonetheless they still depend rather heavily upon personal evaluations by the respondents, and to some extent by the interviewers of attitudes towards labor force status rather than upon objective criteria.

"Perfection cannot be expected in this field because of the continued existence of marginal situations which complicate classification, the practice of obtaining information about all members of a household through one of them, and the need for utilizing rigid lines of demarcation between the different groups in the population when in fact they may be more or less fluid. Nevertheless considerable improvement seems possible through additional experimentation with the concepts and questionnaires used in the interviewing and by other means.

"Additional improvements can be made in the system of questioning which is used by interviewers to obtain the required information. Similarly, improvements can be made in the schedule forms of the questionnaires. These reviews and improvements should be undertaken, as in the past, in cooperation with other governmental agencies and should be facilitated by adequate budgetary provisions and by the increase in the specialized staff qualified in the field of labor market behavior.

"9. The Current Population Survey has been operated under severe restrictions due to limitation and uncertainty of budgetary allocations. Budgetary problems, in part, have contributed to the difficulties which have arisen in the transition from the old to the new sample design. It is the hope of the Committee that Congress will be asked to provide and will provide sufficient funds to support the work needed to insure the maximum accuracy of the survey results on the basis of the present design and for subsequent strengthening of the sample in line with the Committee's recommendations.

"10. The Committee is fully aware of the limited extent of its inquiry and believes that a larger and more representative committee with greater resources than those available to this Committee should be appointed to carry forward the study of this problem in cooperation with the Bureau of the Census. Such a committee, composed of persons both from within and without the government, should be broadly representative of the various groups concerned with the labor market analysis, including persons in professions, the administration of unemployment insurance and employment services, defense planning, business, labor and agriculture as well as economic and population research workers concerned with this area. The Committee should also include proper representation of persons who by their experience and competence are well

qualified to contribute to the solution of the many technical and statistical problems in this field."

Copies of the Report of the Special Advisory Committee on Employment Statistics are available from the Office of the Assistant Director for Statistical Standards, Bureau of the Census, Washington 25, D. C. A limited supply of supplemental materials constituting appendixes to the committee report is also available.

ROBERT W. BURGESS, *Director,*
Bureau of the Census

Seasonally-Adjusted Indexes and Estimates of Employment

The Bureau of Labor Statistics has initiated publication, in its monthly release on *Employment and Earnings*, of seasonally-adjusted indexes and estimates of employment. Release of these series adjusted for seasonal variation makes available an important analytical tool for appraising month-to-month changes in employment. For many industries employment series reflect a regularly recurring seasonal movement which can be measured on the basis of past experience. By eliminating that part of the change in employment which can be ascribed to usual seasonal variation, the cyclical and other nonseasonal movements in the series can be clarified.

The new indexes show seasonally-adjusted total employment in nonagricultural establishments by industry division, and seasonally-adjusted production worker employment in manufacturing by major industry group. The base period is the average monthly employment for 1947–49. Employment indexes which are not adjusted for seasonal variation are also published in the same detail, to facilitate comparison with the adjusted indexes. The seasonally-adjusted aggregates are also given for all employees in nonagricultural establishments by industry division, and production workers in manufacturing by industry group.

Employment estimates adjusted for seasonal variation, based on BLS employment data, have been computed for many years by the Federal Reserve Board. BLS has adopted the Federal Reserve policy of continuing scrutiny of the monthly adjustment factors, introducing modifications as needed. For the present BLS is using, for the indexes and the aggregates, the monthly factors which have been developed by Federal Reserve and were in use in September 1954.

The adjusted indexes and aggregates are presented for the current month, the two preceding months, and the current month a year ago. Computations of data through August 1954 were done by Federal Reserve, and those for September and subsequent months by BLS.

DUDLEY E. YOUNG,
Assistant Chief for Statistics,
Division of Manpower and Employment Statistics,
Bureau of Labor Statistics

Reports on Census Bureau Shipping Statistics Program

A pamphlet entitled "Description of the Shipping Statistics Program of the Bureau of the Census" has been released, as a supplement to the *Catalog of United States Foreign Trade Statistical Publications*. It also appears in condensed form as an appendix to the *Catalog of United States Census Publications*, January–September 1954 issue.

The pamphlet reflects the continuing progress that has been made since 1941 in carrying out an interagency program to coordinate the collection and distribution of United States vessel shipping statistics. It presents a detailed description of the types of reports and special statistical services offered by the Bureau of the Census under its shipping statistics program. Sample exhibits of the unpublished shipping statistics tabulations available for public reference as well as summary statements on the historical development of the interagency program, the source documents of the vessel data, coverage, methods of distributing reports, and descriptions of the various schedules used in compiling the vessel shipping statistics also appear in the brochure.

Copies of the "Description of the Shipping Statistics Program of the Bureau of the Census" are obtainable on request to the Foreign Trade Division, Bureau of the Census, Washington 25, D. C.

Two other reports on shipping statistics have recently been issued by the Bureau of the Census. In response to the large number of requests for statistical information on the foreign water-borne trade of the United States Great Lakes area which resulted from the United States participation in the St. Lawrence Seaway Project, the Census Bureau prepared a special report on "United States Waterborne Foreign Trade of Great Lakes Area, 1953." This report, which was released in the October 1954 issue of the *Business Information Service* series of the Department of Commerce, presents summary information on the water-borne trade of that area for the years 1952 and 1953. Copies of the report are available on request to the Sales and Distribution Division, Department of Commerce, Room 6227, Washington 25, D. C., at a cost of 15 cents a copy.

In conjunction with the regular shipping statistics program of the Bureau of the Census, the annual article, "United States Foreign Water-borne Commerce—A Review of 1953," was published in the September 1954 issue of the *Business Information Service* series. This article presents a statistical review of vessel cargo movements in the foreign commerce of the United States during 1953 and earlier years. Copies of the article are available on request to the Sales and Distribution Division, Department of Commerce, Room 6227, Washington 25, D. C., at a cost of 25 cents per copy.

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Census Tract Publications Since 1950: Annotated Bibliography

The Bureau of the Census has recently issued an annotated bibliography "Census Tract Publications Since 1950," which contains a listing of census tract publications based upon 1950 Census data or currently collected local data. The bibliography was compiled with the cooperation of the census tract key persons in the various tracted areas, who were the chief source of information.

This bibliography is the first attempt to meet the need for a comprehensive listing of census tract publications. The listings reveal the extensive and diverse uses which are being made of census tracts in marketing analysis, in demographic, public health and social problems, and in planning and research activities. The Bureau of the Census is planning to issue supplements from time to time containing additional listings.

Copies of the bibliography may be purchased at 40 cents each, from the Geography Division, Bureau of the Census, Washington 25, D. C.

TOSHI TOKI,
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THE RELATIONSHIP OF CANCER OF THE LUNG AND THE USE OF TOBACCO

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Two years ago cancer of the lung was an unfamiliar and little discussed disease outside the pages of medical journals. Today it is a common topic of discussion, apparently throughout the entire world. The newspapers, radio, television, popular magazines, business and trade journals vie with medical journals for the last word on the relationship of lung cancer and the use of tobacco. This topic has become the featured subject on the program of almost every up-to-date and alert organization interested in medical and health problems.

It is difficult to think of another disease which has sprung so quickly from obscurity to world-wide consciousness. Perhaps the last prior example was influenza in 1918 but this was due to a world-wide epidemic.

In spite of the publicity that cancer of the lung has received, few persons have more than a very hazy conception of its importance as a cause of morbidity and mortality or of the nature of the evidence connecting it with the use of tobacco. The subject is too complicated to be thoroughly discussed in a brief article so that I shall attempt only to sketch the broad outlines of the problem and to indicate the nature of the evidence pointing to an association of cancer of the lung with the use of tobacco, in particular the smoking of cigarettes.

Morbidity and Mortality from Cancer of the Lung

Prior to 1900 lung cancer was a rarely diagnosed disease. In England and Wales which has one of the longest series of mortality statistics, the crude death rate from lung cancer was 8 per 1,000,000 in 1900; by 1950, the rate was 278 per 1,000,000. By the end of 1952 it had reached 321. Part of this increase resulted from an increase in the proportion of the population at the older ages but after allowing for this change, the increase was about twentyfold between 1900 and 1950.

In the United States, the earliest official mortality statistics are for the death registration states of 1914 which included 67 percent of the total population of the country. These statistics came from a special tabulation since cancer of the respiratory system did not appear as a separate rubric in the International List of Causes of Death until the fourth revision in 1929. In 1914 only 0.7 percent of cancer deaths and 0.04 percent of all deaths were attributed to cancer of the lung.

Preliminary statistics for 1953 indicate that about 23,000 or 10 percent of the 229,000 deaths from cancer and 1.5 percent of the 1,519,000 deaths from all causes were attributed to cancer of the lung. Cancer of the lung and bronchus among males now outranks every form of cancer as a cause of death. More than 20 percent of the deaths from cancer among males between 45 and 70 years of age are attributed to lung cancer.

If the age adjusted mortality rate in 1914 is taken as 100, the relative rates for white males and females have been as follows:

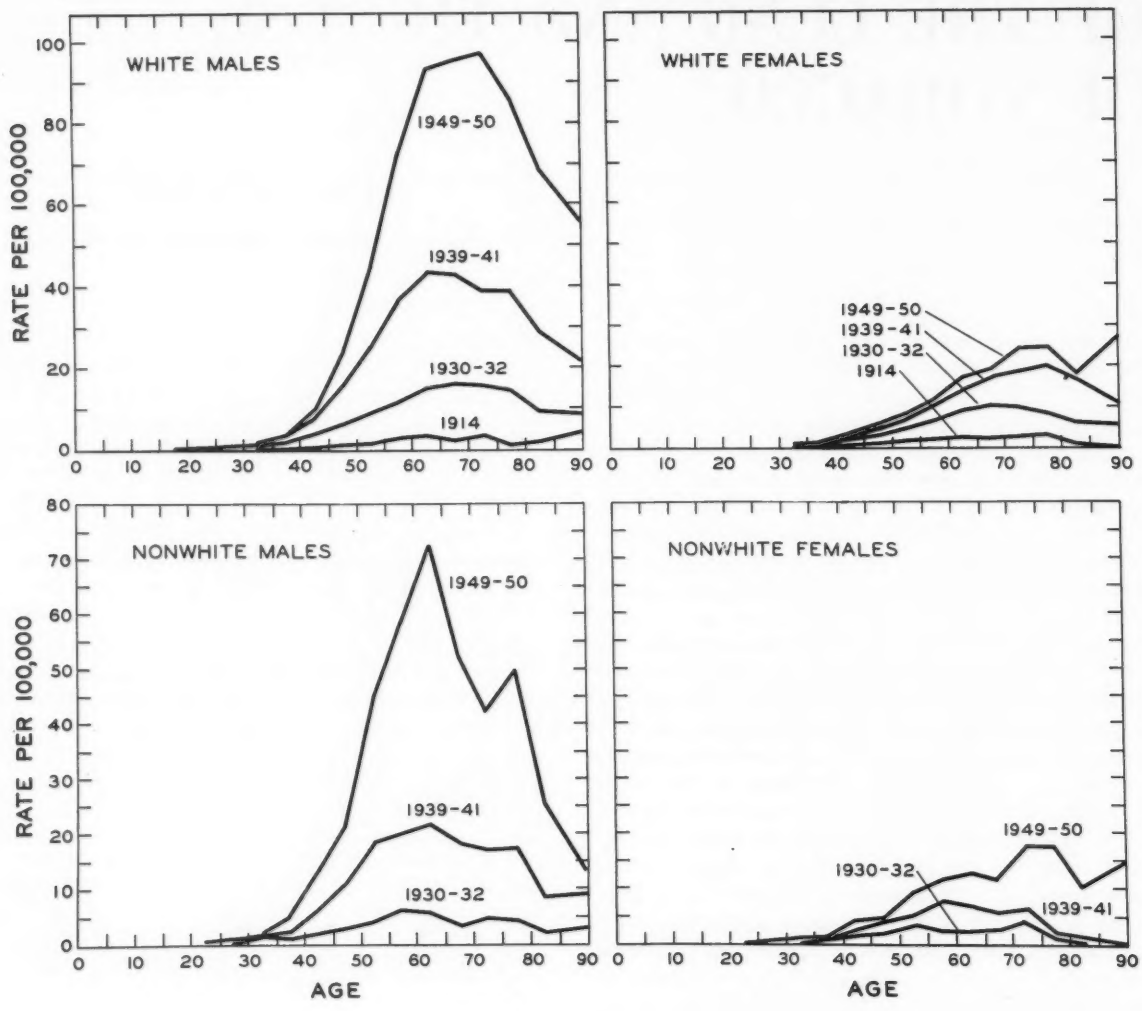
Years	White Males	White Females
1914	100	100
1930–32	493	328
1939–41	1132	547
1949–50	2467	656

The average rate per 100,000 population during 1949–50 was 19.8 for white males and 4.5 for white females. Age specific mortality rates for cancer of the lung by sex and color are shown in Figure 1.

Morbidity data for cancer are not available for the total population of the United States. Studies conducted by the National Cancer Institute during 1947 and 1948 in 10 metropolitan areas with an aggregate population of about fifteen million persons yielded an annual incidence rate (number of newly diagnosed cases) per 100,000 population of 29 for males and 6.5 for females. From these data, it is estimated that about 30,000 new cases of lung cancer were diagnosed in the United States during 1953.

Does the recorded increase in morbidity and mortality from lung cancer represent a real increase in the

Figure 1. Number of deaths per 100,000 population from cancer of the Lung, bronchus and pleura by age, sex and color, United States 1914, 1930-32, 1939-41 and 1949-50.



frequency with which this disease develops in the population or is part or all of it due to improved methods of diagnosis and more complete case finding? Since there are no reliable data that directly relate to this question, the answer must be largely a matter of opinion.

The answer has been a matter of dispute for many years. However, I believe it is correct to state that the majority of informed investigators both in the United States and abroad now believe that the major part of the reported increase is real and cannot be attributed to improved methods of diagnosis and more complete case finding, at least insofar as males are concerned.

The increase in lung cancer is not confined to the United States but also has been observed in most of the highly industrialized and urban countries of Northwest Europe where reliable statistics are available. Furthermore no convincing evidence exists to indicate that the increase is likely to cease in the near future.

Possible Causes of Lung Cancer

It is generally believed that the principal causes of lung cancer must be sought among environmental agents. Three major agents or classes of agents have been suggested: (a) atmospheric pollution resulting from motor vehicle exhausts, industrial waste products, dust from tarred roads and combustion of heating fuels; (b) occupational hazards resulting from exposure to chemical and physical agents; and (c) smoking of tobacco.

Traces of substances that will cause cancer in mice or other animals under specified experimental conditions have been recovered from the atmosphere of cities both in the United States and Great Britain. Certain hydrocarbons, known to cause cancer in laboratory animals, have been identified in motor vehicle exhaust gases. No evidence has yet been adduced that these carcinogenic agents exist in sufficient quantity in the atmosphere of cities to cause cancer of the lung in man. Moreover it seems difficult to explain the much higher incidence of lung cancer in men than in women by atmospheric pollution. A number of studies of the effect of atmospheric pollution upon health are now underway so that a better idea of its importance may become available in the future. Present evidence does not indicate that atmospheric pollution is an important cause of lung cancer in the United States.

The existence of occupational hazards capable of causing lung cancer in man has been convincingly demonstrated but the number of employees in occupations with a known hazard is not large. Furthermore many industries with known or suspected cancer hazards have adopted preventive measures. While other occupational carcinogenic agents possibly will be identified in the future, the present known occupational hazards can account for only a small proportion of the cases of lung cancer that develop each year in the United States.

The evidence connecting lung cancer with the smoking of tobacco is more extensive and specific than that for atmospheric pollution and occupational hazards. This evidence is of four kinds: (a) concomitant increase in mortality from lung cancer and consumption of cigarettes, (b) retrospective clinical studies, (c) forward or prospective studies of selected groups and (d) experiments on animals.

Increase in the Consumption of Cigarettes

The consumption of cigarettes has shown an increase parallel to that of mortality from lung cancer. In 1920 the annual consumption of cigarettes per person 15 years of age and over was 630. By 1953, this figure had risen to 3500 or nearly 10 per day for each person aged 15 years or more. During the same period the consumption of tobacco in the form of smoking, chewing and snuff declined from 6.8 to 2.4 pounds per capita.

It does not seem necessary to cite more detailed statistics here since this form of evidence does not merit much weight in deciding whether or not there is an association between the use of tobacco and cancer of the lung. It is easy to cite examples of temporal correlation between two variables that are intrinsically unrelated. If there is a causal relationship between tobacco smoking and cancer of the lung, an increase in the former must be followed by an increase in the latter after appropriate allowance for latent period is made. But the existence of a concomitant increase, while necessary, is not sufficient by itself to establish causality.

Retrospective Clinical Studies

Most of the evidence for an association between the use of tobacco and cancer of the lung is based upon a comparison of the smoking habits of persons with lung cancer and persons without lung cancer. These studies usually have been conducted in the following manner. Patients with cancer of the lung admitted to a single hospital, or, more rarely, those from several hospitals are questioned concerning their smoking habits. The same questions are asked of a group of "control" patients, that is persons without cancer of the lung admitted to the same hospitals.

A summary of the results reported by 14 such studies in five different countries between 1939 and 1954 is shown in Table 1. Two points are noteworthy. Firstly, there is wide variation in the proportions of "nonsmokers" and of "heavy" smokers. Secondly, the percentage of "smokers" and of "heavy" smokers is greater among lung cancer cases than among persons without lung cancer in each study.

Part of the variation among the reported results arises from differences in definition of a smoker and of a heavy smoker. Some studies include only a history of cigarette smoking; others combine a history of cigarette, cigar and pipe smoking. In some studies, the classification by smoking habits is based on the use of tobacco at the time of interview; in others, this is based on the entire history of use.

Most of the persons interviewed in these studies were men. So far as can be determined from published reports, probably not more than one or two percent of the persons for whom data are shown in Table 1 were women.

Whenever separate data have been shown, the difference in the percentage of persons using cigars and pipes among those with lung cancer and among those without lung cancer has been appreciably less than the difference between the percentage of persons using cigarettes. Most of the studies, however, either do not mention this point specifically or convert cigar and pipe tobacco into equivalent cigarettes. The available data do not clearly demonstrate that there is an important difference in the use of cigars and pipe tobacco among persons with lung cancer in contrast to persons without lung cancer.

It should be immediately apparent that the data in Table 1 do not directly answer the question, is the risk of developing lung cancer greater for smokers than for nonsmokers? The data in columns 6–9 show the percentage of persons with or without lung cancer who

TABLE 1

Summary of Findings Reported by 14 Retrospective Clinical Studies on the Association of Smoking and Lung Cancer

Author	Country	Date	Number of Cases		Percent Who Were Nonsmokers Among Those		Percent Who Were Heavy Smokers Among Those		Relative Risk of Lung Cancer[1]	
			With lung cancer	Without lung cancer	With lung cancer	Without lung cancer	With lung cancer	Without lung cancer	All smokers	Heavy smokers
1	2	3	4	5	6	7	8	9	10	11
Muller	Ger.	1939	86	86	3.5	16.3	50.0	10.5	5.4	22.2
Schairer & Schoniger	Ger.	1943	93	270	3.2	15.9	31.2	9.3	5.7	16.7
Wassink	Neth.	1948	136	100	5.0	19.0	55	19	4.5	11.0
Schrek et al	U. S.	1950	82	522	14.6	23.9	18.3	9.2	1.8	3.3
Mills & Porter	U. S.	1950	444	430	7.2	30.4	—	—	5.6	—
Wynder & Graham	U. S.	1950	605	780	1.3	14.6	51.2	19.1	13.0	30.1
McConnel et al	Eng.	1952	93	186	5.4	6.5	38.5	23.8	1.2	1.9
Doll & Hill	Eng.	1952	1357	1357	0.5	4.5	25.0	13.4	9.4	16.8
Wynder & Cornfield	U. S.	1953	63	133	4.1	20.6	67.6	29.3	6.1	11.6
Sadowsky et al	U. S.	1953	477	615	3.8	13.2	46.8	30.7	3.8	5.3
Koulumies	Fin.	1953	728	300	0.6	18.0	65.8	25.0	36.4	79.0
Breslow et al	U. S.	1954	518	518	3.7	10.8	75.6	44.2	3.2	5.0
Levin	U. S.	1954	490	2365	8.0	26.9	52.7	22.7	4.2	7.8
Watson & Conte	U. S.	1954	265	287	1.9	9.7	73	57	5.5	6.5

[1] Relative risk of lung cancer is the ratio of the chances of a smoker developing lung cancer to those of a nonsmoker developing lung cancer. For example, the entry on line one of col. 10, 5.4, means that the risk of a smoker developing lung cancer is 5.4 times that of a nonsmoker.

smoke and not the proportion of persons who develop lung cancer among smokers and nonsmokers.

Without additional data the above question cannot be answered by the data in Table 1. If we are willing to assume that the persons with lung cancer are a representative sample of all persons who develop lung cancer and that the persons without lung cancer are a representative sample of persons without lung cancer, at least insofar as smoking history and exposure to other agents capable of causing lung cancer are concerned, it is possible to estimate the relative risk of developing lung cancer for the two groups (17). The estimated relative risk of lung cancer is shown in columns 10 and 11 of Table 1.

Most of the studies show that the risk of lung cancer is from 3 to 6 times greater for smokers than for nonsmokers. The rather wide range from 1.2 to 36.4 is due to the same factors that produce the range in the percentages in columns 6–9.

Although estimates of the relative risk of developing lung cancer are of interest, they cannot be properly evaluated in the absence of information about the absolute risk. Using data on the incidence rate of lung cancer from morbidity surveys conducted by the National Cancer Institute in combination with estimates of the relative risk of cancer of the lung among smokers and nonsmokers from the combined studies of Doll and Hill, Wynder and Graham and Sadowsky, Gilliam and Cornfield, Cutler and Loveland prepared the following estimates of the risk of lung cancer for white males between 30 and 50 years of age in 1950 (14):

Smoking Class	Expected No. of Cases of Lung Cancer per 1,000		
	By age 80	By age 70	By age 60
All classes	43	27	11
Nonsmokers	6	4	2
Smokers			
½ pack or less per day	25	16	6
½ pack–1 pack per day	49	30	11
More than 1 pack per day	80	53	23

Forward Studies of Selected Groups

The studies summarized in Table 1 have been criticized on the grounds that:

1. The samples of persons interviewed were not selected in accordance with the principles of probability sampling and hence cannot be used as a basis for generalization beyond the group studied.

2. The retrospective method used in these studies does not provide a direct measure of the risk of developing lung cancer.

3. The histories may have been biased since the interviewers, in some studies at least, knew that the person interviewed had lung cancer at the time of interview.

In order to meet some of the criticisms raised against the retrospective clinical studies, three forward or follow-up studies have been started, one in Great Britain and two in the United States. In the fall of 1951, under the auspices of the Medical Research Council of Great Britain, a questionnaire on the use of

tobacco was sent to 59,600 physicians on the Medical Register. Useable replies were received from 40,564 persons. Whenever a respondent dies, information concerning the cause of death is obtained from the Registrar-General.

During 1952 volunteer workers of the American Cancer Society obtained smoking histories from 198,462 men between the ages of 50 and 69 years living in New Jersey, New York, Pennsylvania, Michigan, Illinois, Wisconsin, Minnesota, Iowa and California. At periodic intervals each volunteer worker is asked to report whether each person interviewed is alive or dead. An abstract of the death certificate is requested when a death is reported.

Beginning in January 1954 the United States Public Health Service with the cooperation of the Veterans Administration initiated a follow-up study of 291,000 holders of the U. S. Government Life Insurance, a policy available to veterans from World War I until 1940. A questionnaire on the use of tobacco was sent to each policyholder. About 220,000 replies were received in response to the first mailing. The Public Health Service is notified whenever a policy is cashed. The entire group is being studied irrespective of whether a history of the use of tobacco is obtained. Whenever a policyholder dies, medical information concerning the cause of death is assembled from death certificates, hospital records and autopsy reports.

Preliminary results have been published for the study of physicians in Great Britain and for the study conducted by the American Cancer Society. The report by Doll and Hill of Great Britain was based on 789 deaths from all causes (15). The estimated death rate per 1,000 men (aged 35 years and over) per annum was:

Cause of Death	Men Smoking (per day)				No. of Deaths
	None	1–14 g.	15–24 g.	25 or more g.	
Lung cancer	0.00	0.48	0.67	1.14	36
Coronary thrombosis	3.89	3.91	4.71	5.15	235
All causes	13.61	13.42	13.38	16.30	789

Death rates increased with an increase in the average amount of tobacco smoked for lung cancer and for coronary thrombosis but not for other causes nor for all causes as a group.

Hammond and Horn in an analysis of 4,854 deaths among the men being followed by the American Cancer Society found an increased death rate among smokers not only for lung cancer and coronary disease but also for all forms of cancer as a group and for total mortality. Using the observed death rates of men who had never smoked as a standard, they computed the number of deaths for the various classes of smokers that would have been expected if each class had experienced the death rate of nonsmokers (16).

Cause of Death	Number of Deaths		Ratio Observed to Expected
	Observed	Expected	
History of regular smoking of any type			
Coronary disease	1748	1174	1.49
Cancer	705	401	1.76
All others	1435	1244	1.15
Total	3888	2819	1.38
History of regular cigarette smoking only			
Coronary disease	828	455	1.82
Cancer	334	162	2.06
All others	665	502	1.32
Total	1827	1119	1.63

For lung cancer alone they reported the following death rates (these are not comparable with those reported by Doll and Hill).

Type of Smoking	Death Rate	No. of Deaths
Never smoked	27.2	12
Cigars and/or pipe but not cigarettes	33.5	12
Cigarettes		
Less than 1 pack per day	113.1	62
1 pack or more per day	239.2	61

Animal Experiments

Attempts to produce cancer in experimental animals with tobacco tar have been made for at least 20 years. Efforts to induce lung cancer in mice by inhalation have been almost uniformly unsuccessful. Essenberg reported an excess of primary pulmonary adenomas in mice forced to inhale tobacco smoke but this finding has not been confirmed by other investigators.

Most of the early attempts to induce skin cancer in animals by painting with tobacco tar extracts either failed or resulted in benign papillomas only. Recently, Wynder, Graham and Croninger reported that 44 percent of 81 mice painted with tobacco tar developed true carcinoma of the skin.

Efforts to identify any of the known animal carcinogens in tobacco or in the products of burning tobacco have been unsuccessful. In a recent publication, Schmahl, Consbruch and Druckery stated they had found a substance in cigarette smoke that fluoresced in ultra violet light in a manner similar to certain aromatic hydrocarbons which are carcinogenic for animals. Up to 98 percent of the fluorescing substance was retained in the lungs when inhaled. They were unsuccessful in identifying the substance.

The published experimental evidence indicates that products formed by the combustion of tobacco may cause skin cancer in mice. Compared to other known carcinogens, this substance is relatively weak.

In summary, a variety of evidence leads to the

conclusion that the mortality from lung cancer is higher among smokers than among nonsmokers and that this difference is greater for cigarette smokers than for cigar or pipe smokers. The same conclusion probably also holds true for coronary disease. Animal experiments suggest that tobacco tar contains a mildly carcinogenic substance that will cause cancer of the skin in mice. Beyond this the evidence is conflicting.

There is a strong tendency on the part of some to expend much time and energy in debating whether the available evidence indicates a "mere" association or a causal connection between cigarette smoking and lung cancer. This argument has some of the earmarks of the proverbial small boy whistling loudly as he passes a cemetery. There is a distinction between association and causality in biology and medicine but this distinction is not nearly as clear-cut as some have implied.

When we make a scientific generalization in biology or medicine we rarely can assert this generalization with complete certainty. Rather, we imply that based on available knowledge the generalization has a high probability of being correct, but also that this probability is subject to modification as new knowledge becomes available. We can never be certain that additional knowledge may not show that the generalization needs major modification even after it has been accepted as being true.

Since our customs, ethics and laws forbid deliberate experimentation on human beings when this conceivably may be detrimental to their health or well-being, knowledge of the carcinogenic properties of a suspected agent must rest upon indirect and circumstantial evidence. The principal methods that have been used to establish etiology are:

1. *Animal experimentation.* It sometimes is thought the results of animal experimentation will establish or disprove that a substance can cause cancer in man. This is untrue. The successful induction of tumors in an animal, such as the mouse, does not establish carcinogenicity for man. Similarly the failure to induce tumors experimentally does not prove the agent employed will not cause cancer in man. Nevertheless if an agent will cause cancer in an animal, this fact raises the suspicion that the agent also may be carcinogenic for human beings.
2. *Removal or counteraction of suspected agent.* If the increased incidence of a disease disappears after the removal of the suspected agent or the counteraction of its effects, belief in the etiological action of the agent is strengthened.
3. *Clinical study and observation of patients with disease.* In addition to the history and course of disease in individuals with different characteristics and under varying circumstances, this includes study of the effect of therapeutic methods such as chemotherapy, surgery and radiation.
4. *Epidemiological studies.* The detection of any or all of the following furnishes evidence of the possible etiological relationship between the development of cancer and a suspected agent: increased incidence of disease after exposure to the agent, localization of cancer in a specific site, shift toward a younger age at onset of disease, exposure to the same agent of all persons who develop a particular form of cancer, and observation of an unusual incidence of pathological conditions such as chronic dermatitis and papillomas which may precede the development of cancer.

No one of these methods usually is sufficient to establish etiology with a probability sufficiently high to convince the majority of informed persons. More generally, belief in a causal relationship between an agent and a disease rests upon a synthesis of all known facts concerning the agent and the disease.

During the early stages of the collection and analysis of information the opinions of investigators concerning the interpretation of the available evidence are often conflicting. This critical examination and evaluation of observed data in turn stimulates the investigation of disputed points so that little by little evidence is accumulated until the majority of investigators agree that an etiological connection between the agent and the disease either has been established or placed in doubt.

Many questions remain to be answered. These include: what is the magnitude of the mortality differential between smokers and nonsmokers, why is the mortality differential small or nonexistent for cigar and pipe smokers and not for cigarette smokers, how important is the mortality differential as a health and medical problem, for what diseases other than lung cancer and coronary disease does a mortality differential exist, is the mortality differential due to something in tobacco itself, or does it result from the method of smoking?

Additional experimental and laboratory studies of the composition and possible carcinogenic properties of tobacco are required. Such experiments, however, cannot be decisive. The final judgment concerning the effect of smoking tobacco upon health must be based upon observations on smokers and nonsmokers.

Meanwhile in the controversy over the relationship of the use of tobacco and health it is essential to preserve a sharp differentiation between the factual results of studies and experiments and the interpretation of these results by smokers and nonsmokers alike.

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SOME APPLICATIONS OF EXTREME-VALUE METHODS

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Introduction

Classical applications of statistical methods, which frequently concern average values and other quantities following the symmetrical normal distribution, are inadequate when the quantity of interest is the largest or the smallest in a set of magnitudes. This is the situation in a number of fields, in many of which applications of methods for dealing with extremes have already been made.

The literature on extreme value methods and applications is extensive. However, since it has largely developed in response to specific problems, it has until very recently been widely scattered in numerous subject-matter publications and was therefore not readily accessible to the general research public.

This limitation has now been removed with the publication by the National Bureau of Standards of *Statistical Theory of Extreme Values and Some Practical Applications*, a series of lectures [14][1] by one of the authors giving a comprehensive and unified account of the subject and including a comprehensive bibliography. A companion volume of tables was issued earlier [24]. The National Bureau of Standards has had a considerable interest in this subject, being concerned with the mathematical treatment of extreme values and the utilization of these and other data as a means of predicting future performance. One statistical program, originally sponsored by the National Advisory Committee for Aeronautics, was concerned with predicting the maximum gust velocities that aircraft structures would be likely to encounter [22].

The aim of this article is to present a brief survey of the nature of extreme-value methods and illustrate their use by several typical applications. The text is based primarily on material in Lectures 1 and 4 of [14], and the first application is taken from Lecture 4 of the same source. These may be consulted for further details of the methods or applications referred to here.

[1] Numbers in brackets refer to the listing at the end of the article.

The field is constantly growing,[2] and considerable additional work has already appeared since preparation of the lectures for publication was undertaken. Some of these are listed at the end of the article.

Fields of Application

Meteorological phenomena that involve extreme pressures, temperatures, rainfalls, wind velocities, etc., may be treated by extreme-value techniques. Such extreme data are assuming ever increasing importance in the activities of modern life. For example, one of the important revisions of certain standard building code requirements [25, page 23] now under consideration is to replace the concept of "maximum wind velocities averaged over 5 minutes" by "extreme wind velocities" in the determination of suitable design wind pressures. This change has been recommended by the United States Weather Bureau in the realization that an exceptional velocity may be obscured in the process of averaging, leading to an underestimate of projected conditions which the structure is being designed to withstand. The proposed revision thus points to a problem of extreme-value analysis.

Extreme-value techniques are also applicable in the study of floods [2, 6, 8, 17, 20, 23] and droughts [15, 26]. A forecast of floods is necessary for the construction of channels, bridges, reservoirs, dams, and hydroelectric plants. The study of droughts is of essential value in treating problems arising from stream pollution, sewage disposal, and water supply. Still other examples occur in the fracturing of metals, textiles, and other materials under applied force, and in fatigue phenomena [1, 11, 12, 18]. In these instances, the observed strength of a specimen often differs from the

[2] Recent examples of application in distant places that have come to our attention have been to water supply studies for the Derwent River in England; studies for the State Hydroelectric Department in Wellington, New Zealand [3, 9] rubber tensile testing in a rubber factory in Osaka, Japan [19]; and estimation of design rainstorms and design floods in a river valley in India and in Turkey.

calculated strength, and depends, among other things, upon the length and volume. An explanation is to be found in the existence of weakening flaws assumed to be distributed at random in the body and assumed not to influence one another in any way. The observed strength is determined by that of the weakest region. It is thus apparent that whenever extreme observations are encountered it will pay to consider the use of extreme-value techniques.

Use of Extreme-value Technique

Figure 1 illustrates the frequency form of a typical curve for the distribution of largest observations.

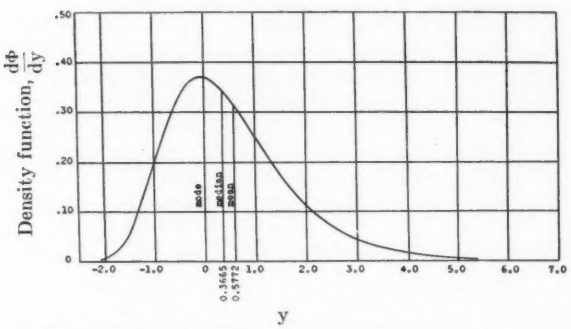

Fig. 1—Theoretical distribution of largest values.

Unlike the normal distribution this curve is skewed—rising to a maximum to one side of the mean. The chief feature of such a distribution is that very large values have a much greater chance of occurring than very small values. This agrees with common experience. Very low maximum values are most unusual, while very high ones do occasionally occur. Theoretical considerations lead to a curve of this nature, called the distribution of largest values or the extreme-value distribution. Such questions were first studied intensively by Fisher and Tippett, [10], and in recent years the theory has been successfully applied to a number of engineering problems.

The extreme-value distribution was derived by a limiting process. The *exact* distribution of the largest value, x_n, in a random sample of size n is

$$\text{Prob}\,[x_n < x] = [F(x)]^n \qquad (1)$$

where $F(x)$ is the cumulative distribution function (c.d.f.) for the parent population from which the sample is drawn. This expression was felt to be inconvenient for computational and theoretical purposes, when n is large, or when the parent population $F(x)$ is unknown. The early investigators sought an asymptotic approximation, that is, one increasingly valid for larger and larger n, that would also be usable for moderate values. Three types of limiting distributions were obtained, of which the most useful had the c.d.f.

$$\Phi(y) = \exp\,[-\exp(-y)], \qquad (2)$$

where y is simply a linear function of the observed variate x appearing in (1) with coefficients theoretically determined by the sample size and parent population but in practice estimated from the sample of extreme values alone. Equation (2) is the formula for the "extreme-value distribution" referred to previously. It applies to distributions of the so-called "exponential type". This is a general class to which the exponential, chi-square, logistic, and many others belong, as well as the normal. For details of this and other points raised in this paper, see the basic reference [14].

In using the extreme-value method, all the observed maxima, such as the largest wind velocity observed in each year during a fifty-year period, are first ranked in order of size from the smallest to the largest. These values are given ranks 1 to n and are then transformed into cumulative frequencies P_i by the relation $P_i = i/(n + 1)$, where i is the rank of the i^{th} observation counting from the smallest. Thus a plotting position is obtained for each observation. The data are plotted on a special graph paper, called extreme-value probability paper, designed so that the "ideal" extreme-value distribution will plot exactly as a straight line. Consequently, the closeness of the plotted points to a straight line is an indication of how well the data fit the theory.

Extreme-value probability paper has a uniform scale along one axis, usually the vertical, which is used for the observed values, as in Figure 2. The horizontal axis then serves as the probability scale and is marked according to the doubly-exponential formula. (2) Thus, in Figure 2, the space between 0.01 and 0.5 is much less than the space between 0.5 and 0.99. The limiting values 0 and 1 are never reached, as is true of any probability paper designed for an unlimited variate.

An extreme-value plot of the maximum atmospheric pressures in Bergen, Norway for the period between 1857 and 1926 (Figure 2) showed by inspection that the observed data satisfactorily fitted the theory. From the fitted straight line it is possible to predict, for example, that a pressure of 793mm corresponds to a probability of 0.994, that is, pressures of this magnitude have less than 1 chance in 100 of being exceeded in any particular year. In studies of the normal acceleration increments experienced by an airplane flying through gusty air [16, page 394], an instrument was employed that indicated only the maximum shocks. Thus, only one maximum value was obtained from a single flight. A plot representing 26 flights of the same aircraft indicated that the probability that the most violent gust will not be exceeded in any other flight was 0.96, i.e., a chance of four in 100 of encountering a more

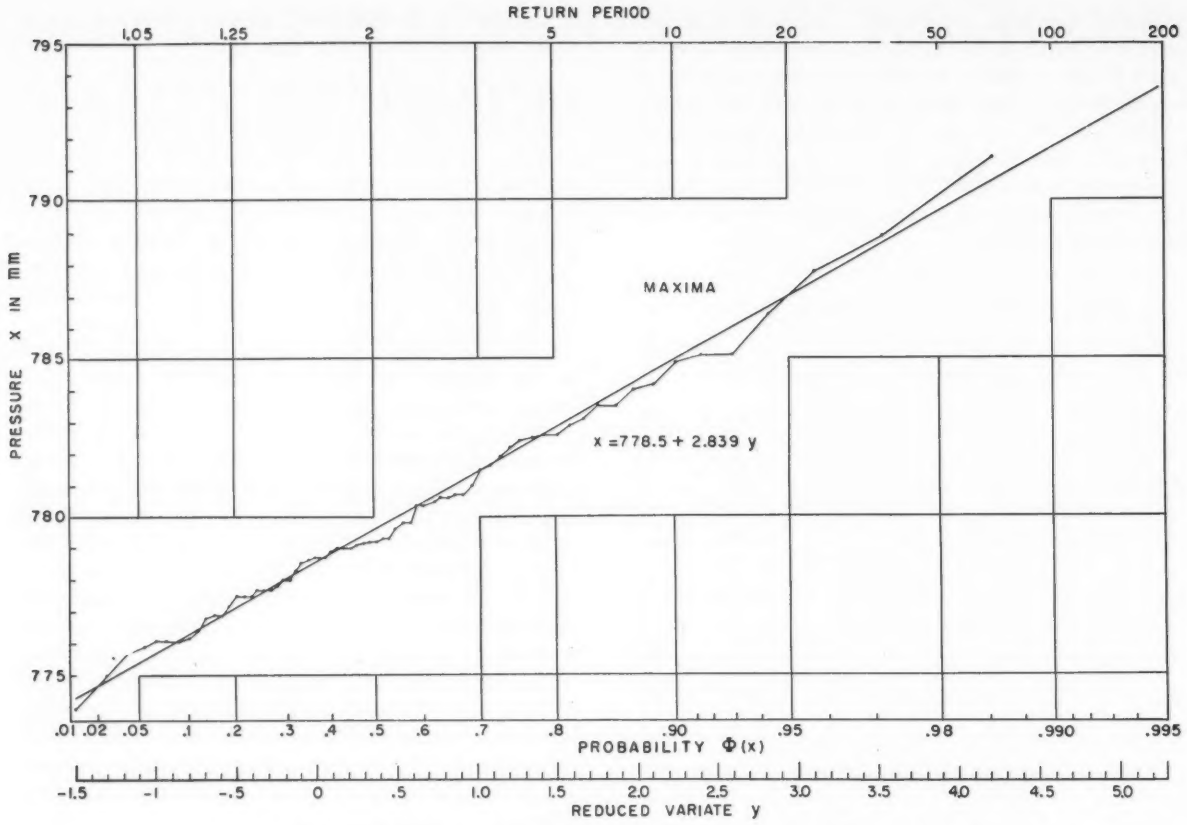

Fig. 2.—Annual maxima of atmospheric pressures, Bergen, Norway, 1857–1926.

severe gust than any recorded. A more recent study by one of the authors [22] presents refinements especially adapted to very small samples of extreme data and also to larger samples where it is necessary to obtain the greatest amount of information from a limited set of costly data.

Smallest Values

Extreme-value theory can also be used to study the smallest observations, since the corresponding limiting distribution is simply related to the one previously given. The steps in applying the "smallest-value" theory are also very similar to the largest-value case. For example, engineers have long been interested in the problem of predicting the tensile strength of a bar or specimen of homogeneous material. One approach is to regard the specimen as being composed of a large number of pieces of very short length. The tensile strength of the entire specimen is obviously limited by the strength of the weakest of these small pieces. Thus the tensile strength at which the entire specimen will fail is a smallest-value phenomenon. The smallest-value approach can be used even though the number and individual strengths of the "small pieces" are unknown.

This method has been applied with considerable success by Shigeo Kase in studying the tensile testing of rubber [19]. Using 200 specimens obtained so as to assure as much homogeneity as possible, he found that the observed distribution of their tensile strengths could be fitted remarkably well by the extreme-value distribution for smallest values. The fitted curve given by the data indicates that one-half of a test group of specimens may be expected to break under a tensile stress of 105 kg./cm.^{2} or more, while only 1 in a thousand will survive a stress exceeding 126 kg./cm.^{2}.

Extreme-value theory was first extensively applied to the problem of floods. The yearly maxima of all the 365 daily flows of the Tennessee and Cumberland Rivers were recorded for periods of about 60 and 90 years, respectively. These maxima are plotted on extreme-value probability paper, from which can be read the probability that a flood of any given magnitude will

be exceeded in a single year. The information is useful for classifying streams and rivers in several statewide areas, which permits their orderly study and serves as a guide for planning purposes [4, 5].

Recent Literature

As noted above, additional material has become available since *Statistical Theory of Extreme Values and Some Practical Applications* was prepared for publication. The principal items are listed below, including those already cited:

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REPORT OF ASA REPRESENTATIVES TO THE SOCIAL SCIENCE RESEARCH COUNCIL

This interim report supplements that submitted to the Board of Directors of the American Statistical Association on December 15, 1953. As such, it is limited to those recent developments of the Social Science Research Council that may interest members of the A. S. A. Activities mentioned in the earlier report which are in normal progress will not be repeated here.

1. Mathematical Training of Social Scientists

The last summer Institute on the Mathematical Training of Social Scientists was held at Dartmouth College in 1953. An Institute is not planned for 1954. Two summer Institutes are planned for 1955 with Stanford University and the University of Michigan as host institutions. Both Institutes will have two programs, one designed for students without training in calculus and the other for those with such training.

During two summer months of 1954, Drs. Robert Abelson, Robert R. Bush, and Ray Hyman are preparing materials to assist in the teaching of mathematics to psychologists. Dr. Harold W. Kuhn is assembling materials to assist in teaching related to the theory of games and linear programming. With Dr. Jacob Marshak as consultant, Gerard Debreu of the Cowles Commission will work on certain phases of mathematical economics not covered by Dr. Kuhn, namely: consumers' needs and economic behavior, technology and behavior of producers, economic systems, and competitive market equilibrium. A contribution has been made to the Writing Group of the Mathematical Association of America, Inc., working at the University of Kansas in the summer of 1954 on the preparation of an introductory mathematics course for college students. Dr. Samuel Goldberg of Oberlin College has completed a draft of an introduction to difference equations for the elementary student and is exploring publication possibilities.

2. Measurement of Opinion, Attitudes and Consumer Wants

The University of Chicago Press has scheduled for fall publication the final report of the National Opinion Research Center concerned with the measurement and control of interviewer effect.

3. Labor Market Research

The volume "Labor Mobility in Six Cities," by Gladys Palmer and Carol P. Brainard, and the volume of papers "Labor Mobility and Economic Opportunity" by several contributors who summarized results of research were published early this summer. This autumn, there is expected off the press "Research in Labor Mobility: An Appraisal of Research Findings in the United States," by Herbert S. Parnes.

4. Economic Growth

Arrangements have been made with European scholars for a study of the historical development of national income in Germany in the nineteenth and early twentieth centuries, and for a review of estimates of national income and wealth for Italy since 1860.

A conference held in New York in April was concerned with strategic factors in periods of very rapid growth. A second conference held in Chicago in May dealt with the role of cities in economic growth and cultural change.

5. Summer Research Training Institutes

With funds granted by the Ford Foundation, the Social Sciences Research Council will support summer institutes for the postdoctoral training of social scientists for four years. These institutes will be modeled, in some respects, on the pattern of the Institute on the Mathematical Training of Social Scientists. The Social Science Research Council will welcome inquiries and proposals regarding the organization of institutes in particular fields of training.

6. Undergraduate Research Training

The first stipends under this program, which were granted in 1953, sponsored summer research in the social sciences by college juniors under the guidance of faculty members. For the summer of 1954, the Social Science Research Council granted 45 such undergraduate stipends.

7. Fellowship and Grants-in-Aid

Six faculty research fellowships were awarded for a three year period. Research training fellowships were awarded to 28 students and 30 grants-in-aid were given to social scientists for the pursuit of research projects.

As Representatives of the American Statistical Association to the Social Science Research Council, we are gratified with the attention given to and the interest shown in statistical method and substance in the activities of the Council.

Respectfully submitted,

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S. S. WILKS
MORTIMER SPIEGELMAN

QUESTIONS AND ANSWERS

Edited By ERNEST RUBIN
U. S. Department of Commerce
and American University

Statistical Relationships and Proof in Medicine

Within the last two years a formidable controversy has developed as a result of investigations concerning smoking and lung cancer. Statistical data indicate that smokers have a higher incidence of lung cancer than non-smokers. The experience with the smoking—lung cancer controversy suggested the following question: Are there instances in the history of medicine in which a statistical association proved causation or has the proof of a causal relationship in medicine always depended on direct experimentation? I wish to thank Mr. Jerome Cornfield of the Office of Biometry, National Institutes of Health for preparing the following analysis of this question.

There are several preliminary issues raised by the question that need prior discussion. The first, the concept of proof, need not detain us long. Proof has a well-defined meaning in mathematics, but not in empirical science. The truth of a mathematical proposition can be demonstrated; the evidence for an empirical proposition, i.e., a statement in natural science, can be made strong or even overwhelming (despite the apparent impossibility of a satisfactory calculus of evidence). It is doubtful, however, if such propositions can ever be regarded as proved. New evidence (e.g., the discovery of black swans) may cast an entirely different light on a well-established proposition, and in an empirical science, as opposed to mathematics, there are no postulate systems which delimit the kind of new evidence that can be found. If we ask for proof in medicine, or any other empirical science, we may be asking for something that does not exist.

A second issue raised by the question is the exact nature of the distinction between a relationship based upon a statistical association and one based on direct experimentation. We all have a vague feeling that if we can make an event occur, we understand it better than if we simply observe it passively. On analysis this feeling seems to reduce to two propositions like the following: We are initially skeptical of any relationship based upon simple observation because the effects of other possibly important variables are not controlled and may account for the observed association. We are initially impressed by any relationship established by experiment because we feel that the effects of other important variables are controlled and cannot account for the association. The distinction we feel between a relationship based upon a statistical association and one based upon direct experimentation is thus a distinction between relationships that may be explained by other variables and those that cannot.

Although this statement may formalize our intuitions it is an oversimplification of the actual facts. First, there are cases in which uncontrolled observations can be so analyzed as to eliminate the possibility that extraneous variables account for the observed association. The classical example of this is Snow's demonstration (1) in the middle of the nineteenth century, before the birth of bacteriology, that cholera was transmitted through polluted water. Even the most skeptical critic cannot quarrel with the conclusions drawn from his observations on the clustering of deaths about a particular source of polluted water, the famous Broad Street pump; particularly after his demonstration that mortality from cholera among subscribers of a water company that drew its supply from the Thames River was 14 times as high as that among subscribers of the competing company whose water was sewage-free. The official inquiry which followed agreed that "fecalized drinking-water . . . may breed and convey the poison [of cholera]" although with a caution that is perhaps not peculiar to the Victorian era added, "[so would] fecalized air."[1] Nor do we have to go back 100 years to find examples in which the effects of specific extraneous variables were eliminated from observational material by methods short of direct experimentation. Cross-classification of observations is an obvious, but often surprisingly powerful method of accomplishing this, for some recent examples of which references (3, 4, 5 and 6) may be instructive.

Secondly, our intuitions may be misleading because there is no automatic guarantee in any particular instance that extraneous variables have been controlled by direct experimentation. This may seem to deny the

[1] It is not entirely irrelevant to recall at this point the experience of Max von Pettenkofer who, many years later, to prove beyond any doubt that water-borne bacteria did *not* cause cholera, drank, and induced several of his students to drink, a whole glass full of the bacilli. They not only all survived but reported nothing worse than a bellyache (2).

great virtue claimed for randomization, the automatic balancing out among treatment groups of the effects of other variables, whether or not we are aware of their existence. The denial is more apparent than real, however. Consider for example an experiment designed to study the effect of removing an organ, say the thyroid gland, on some biological response, say blood sugar level. We may randomize animals among a control and thyroidectomized group and thus eliminate in the usual probability sense the possibility that any large difference between the two treatments arose from the different characteristics of the animals treated. But we have not eliminated the possible effect of other extraneous variables in which the experimenter is equally interested such as the operation removing the thyroid, or the non-specific effect of thyroidectomy on weight loss. While it is perhaps possible to control these specific variables, for example, sham operation and under feeding the sham operated controls might be regarded as providing such a control (7), randomization by itself is insufficient. We must indicate the specific variables we wish to control and must devise specific experimental procedures to control them.

Having thus argued that there is no difference in kind between the two types of evidence it is of course necessary to add that there is a very important difference in degree. It is a good deal more difficult to control variables in observational than in experimental material, so that the experimental method has unravelled and will continue to unravel mysteries before which uncontrolled observation would be powerless. But there is no difference in principle. There are no such categories as first-class evidence and second-class evidence. There are merely associations, whether observational or experimental that, in a given state of knowledge, can be accounted for in only one way or in several different ways. If the latter, it is our obligation to state what the alternative explanations or variables might be and to see how their effects can be eliminated, while if the former it is equally our obligation to state so. To distinguish between statistical association on the one hand and relationships that are established by experimentation on the other, without any reference to alternative variables that are present in one case but not the other, seems to us to be neither good statistics, good science, nor good philosophy—though it may be good red herring.

If we consider the tobacco-lung cancer question, for example, one possible set of extraneous variables that might explain the higher incidence for smokers are those arising from self-selection. Thus, some small proportion of the population, say 5 percent, might have some special trait (or traits), say high blood levels of certain hormones, which both initiate lung cancer and make the possessors smoke. Of the remaining adult male population, 75 percent smoke for other reasons and do not develop lung cancer. It is possible to conceive but impossible to conduct an experiment that could settle this question. A large group of adolescents would be allocated at random to different smoking groups, compelled to remain on the assigned smoking schedule, followed for the 30 to 60 years required for lung cancer to develop and the lung cancer incidence computed for each group. This and, as nearly as one can see, only this, would entirely eliminate self-selection as an explanation. Short of this one must rely upon indirect evidence. If self-selection were the complete explanation of the difference, then tobacco smoke would not be a carcinogen for human lung tissue. One might consequently investigate this question by asking is it a carcinogen for any other type of tissue that one can reasonably experiment with, say human or mouse skin? If the answer had been no, this might have been regarded as some type of evidence for the self-selection hypothesis, although no one would regard the evidence as very strong. The recent induction of skin tumors in mice by tobacco tars (8) might similarly be considered evidence against the self-selection hypothesis, but again far from strong. In any event the recent announcement by the Tobacco Industry Research Committee that it would investigate psychological differences between smokers and nonsmokers suggests that we have not heard the last of the self-selection hypothesis. No matter what one's opinion on the plausibility of this as an explanation,[2] the actual investigation of whether specific differences that might arise from self-selection do in fact account for the association could be constructive, even if the results obtained were negative.

This discussion of preliminary issues[3] in one sense also disposes of the main question, but the history of medicine on this point is interesting and a few words may be in order. There are numerous instances that one can cite in which the most important source of medical knowledge on a subject was supplied by statistical associations. Thus, the observation that there is a close inverse association between the amount of natural fluorides in water and the amount of dental caries among children drinking it, has induced numer-

[2] It is easy to sympathize with, even if one cannot entirely share the exasperation expressed by Greenwood and Yule on a related point (9). "[The vaccinated group] may all have been vegetarians, or nonsmokers, or red-headed, and all or any of these things may render them less likely to contract cholera; but we do not see why objections which no sensible man would allow to influence him in the ordinary affairs of life should suddenly acquire scientific importance when the question is one of interpreting statistics."

[3] There is one additional preliminary issue that deserves mention. The phrasing of the question suggests that its framer subscribes to the somewhat old-fashioned view that it is either possible or desirable to discuss knowledge without any reference to the possible actions to which it will lead. I have not challenged this view only because I share it.

ous municipalities to add fluorine to their water supply. The resulting decline in the incidence of dental caries in these municipalities may be considered a "direct experimental proof" of the proposition that fluorine inhibits the development of caries, but the fluorine was not added in order to study this question experimentally but rather to bring about a result indicated by the associations. It is true that the results of adding fluorine to the drinking water of experimental animals also pointed in the same direction (10), but as evidence this apparently was not given much weight. Shaw, for example, in his excellent summary of the subject (11) does not even mention the results with experimental animals.

In the study of the effects of therapy the application of modern ideas of experimental design is a very recent development, for an account of which the reader is referred to Hill's very interesting article (12). In recent years there have been several well-conceived experiments to test the efficacy of different preparations, such as gamma globulin, in protecting against the subsequent development of disease. But methods that were established in the past such as vaccination against smallpox, have never received such a carefully controlled experimental test. There are of course dozens of studies to show that individuals who had been voluntarily vaccinated developed less smallpox than others, and that when they did develop it, the outcome was less frequently fatal. But none of these studies ruled out the possibilities of self-selection any more effectively than they are now ruled out in tobacco-lung cancer studies.

In the study of infectious disease there are naturally almost no examples of direct experimental demonstration on humans. Walter Reed's experiments on yellow fever are well known, but it is difficult to find other cases. Perhaps the nearest is the ghastly episode that occurred in Lübeck in 1926, when out of 249 babies accidentally inoculated with enormous numbers of living virulent tubercle bacilli, 76 died (13). If one is willing to overlook the absence of a placebo-inoculated control group, and refrains from asking, "if the bacilli cause tuberculosis, why didn't all the inoculated children develop the disease?", this perhaps is "proof of a causal relationship." (The 173 Lübeck babies who did not die developed only minor lesions and were still free of tuberculosis when last observed 12 years later.)

In short, if we insist on direct experimental demonstration on humans there are many widely held beliefs that must be regarded as without solid foundation. If we believe that vaccination protects against the development of smallpox it is not because there has been a direct experimental demonstration but rather (a) there is a good deal of evidence that is consistent with this hypothesis, and (b) over the course of many years no evidence has been produced to support any alternative hypothesis. The truth of the matter appears to be that medical knowledge (and, one suspects, many other kinds as well) has always advanced by a combination of many different kinds of observation, some controlled, and some uncontrolled, some directly and some only tangentially relevant to the problems at hand. Although some methods of observation and analysis are clearly to be preferred to others when a choice is possible, there are no magical methods that invariably lead to the right answer. If we cannot specify exactly what has been learned in medicine from the study of statistical associations, we can at least say that we could not have accumulated the knowledge we have without them.[4]

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[4] After completing this answer my attention was called to Hill's Cutler Lecture on Preventive Medicine (14) in which much the same issues that we have covered were also considered—in, however, a more comprehensive, lucid (and reasonable) manner. The reader is enthusiastically referred to it if he is at all interested in pursuing the subject.

OPINIONS ON STANDARDS—Continued from inside front cover

It would probably have been better if the follow-ups had been made by letter, with telephone only as a last resort. Since two members were opposed due to the cost, it would also have been better if the original letter had included the committee's recommendation that a grant for the clerical work involved in developing a code should be obtained from a foundation rather than from the Association's funds.

In considering this survey of the opinion of the Boston Chapter, these influences should be recognized:

1. The subject of this survey was the development of a code of ethics rather than the general subject of standards, which would include technical and procedural standards as well as ethical. Establishment of a code of ethics is more debatable than technical standards, such as those developed by the Bureau of the Budget with other agencies: "Standards for the Publication of Statistical Data" (1947) and "Standards for Statistical Surveys" (1952). Opinion needs to be sought on the broader subject.

2. The poll was taken before the issues had been debated in *The American Statistician*. A survey should therefore be made a year from now.

3. The Boston Chapter may not be representative of the Association as a whole, since a series of small meetings to develop ideas for a code of ethics was held 3 years ago as reported in *The American Statistician* for February, 1952. Opinions should therefore be obtained from other Chapters after a suitable time for debate.

This report should be looked upon, therefore, as a preliminary test on the more debatable aspect of the subject in a single Chapter. General conclusions should not be drawn.

The following excerpts are from letters commenting on the general subject of statistical standards, or on the report on the survey of opinion of the Boston Chapter.

1. "Like yourself, I have some misgivings over the significance of the returns from the survey of opinion in the Boston Chapter. From a pure count of the observations, there are obviously more people in favor of the 'Code of Ethics' than opposed. At the same time, with only one-third of the respondents in the first (impersonal) sample *strongly* in favor of the project, I would be hard-pressed to argue that there was enthusiastic support for the idea. And others may maintain that we should have an overwhelming majority convinced of the merit of the proposal before embarking on any such program.

"On the other hand, some ideas are naturally slow to gain support. Often such programs demand a long missionary effort before winning public acceptance. . . . I am therefore in complete agreement with your plan to enlist the support of the local Presidents."

2. "I would be very much interested in knowing the reason for opposition to a study of ethics, other than cost."

3. "An opinion survey should be made in each Chapter, tested by interviews. There should be a local committee of competent surveyors to test the reliability of the survey."

(At the Montreal convention, the Chapter Secretaries advised us not to proceed with a poll now. It seems to us that a survey of opinion should be postponed until the issues have been clarified through discussions in the local chapters and through the columns of "The American Statistician" perhaps a year from now.)

4. "The one large group in the ASA which does not now have protection as professionals consists of those working for business concerns. To this group the establishment of a code of ethics must appear an important means of helping to educate their employers as to the range of their responsibilities, etc. My own hunch is that it is this group which is going to have to initiate and develop some concrete proposals before the academic and Federal employees show any interest in a code. Then the interest of the academic and Federal groups will be one of being certain that the proposed code does not jeopardize the protections they now enjoy."

NEWS—Continued from page 2

The following papers were delivered at the Conference:

The Meaning and Measurement of Full Employment—Albert Rees, University of Chicago

The Meaning and Measurement of Partial and Disguised Unemployment—Louis J. Ducoff and Margaret Jarman Hagood, Agricultural Marketing Service

The Secondary Labor Force and the Measurement of Unemployment—Richard C. Wilcock, University of Illinois

Current Unemployment Statistics of the Census Bureau—Gertrude Bancroft, Bureau of the Census

Unemployment Data from the Employment Security Program—Herbert S. Parnes, Ohio State University

Estimates of Unemployment in the United States, 1900–1952—Stanley Lebergott, Bureau of the Budget

Unemployment by Industry—Some Comments on Its Measurement and Behavior—David L. Kaplan, Bureau of the Census

Unemployment by Industry and Locality—Louis Levine, Bureau of Employment Security

Differential Unemployment and Characteristics of the Unemployed in the United States, 1940–1954—Philip M. Hauser, University of Chicago

Studies of Individual Characteristics of Unemployed Workers—Elizabeth J. Slotkin, Illinois Department of Labor

International Comparison of Unemployment Rates—Walter Galenson and Arnold Zellner, University of California

Employment and Unemployment in the Soviet Union—Warren Eason, Johns Hopkins University and Rand Corporation

The final session was devoted to a synthesis of the papers and discussion presented during the two days of meetings. It is planned to publish all papers and discussions in a volume to be issued in 1955 by the Universities-National Bureau Committee on Economic Research.

NEWS ABOUT MEMBERS

Fred C. Andrews, formerly Research Associate in the Applied Mathematics and Statistics Laboratory, Stanford University, is now Assistant Professor of Mathematics and Assistant Statistician in the College of Agriculture, at the University of Nebraska.

Arthur G. Auble, Associate Professor of Business Statistics, Claremont Men's College, has become associated with the Los Angeles Office of Facts Consolidated, as Research Associate and Statistical Consultant. He will work on the planning of research projects with particular attention to analysis of research findings and techniques of sample distribution.

R. R. Bahadur has been appointed Assistant Professor of Statistics in the Committee on Statistics, University of Chicago.

Ruth C. Bernstein has completed the examinations leading to Associate Membership in the Society of Actuaries. She is employed by the Metropolitan Life Insurance Company.

Claude F. Bridges has a renewable one-year contract to serve as a Measurement and Research Consultant to the Turkish Ministry of Education. The position entails serving as Director of the Turkish Bureau of Measurement and Research; teaching some college classes in measurement research techniques and statistics; and beginning the development of a national educational research program.

James P. Cavin has transferred from the Office of Statistical Standards, Bureau of the Budget, to the Department of Agriculture as Chief of the Statistical and Historical Research Branch, Agricultural Marketing Service.

Douglas G. Chapman is on leave of absence from the Department of Mathematics of the University of Washington. He has a Guggenheim Fellowship for research in statistical methods of wildlife population estimation and is spending the year at the University of Oxford.

J. H. Curtiss has been elected Executive Director of the American Mathematical Society for a term of two years.

Joseph F. Daly has been granted leave from the Bureau of the Census to spend a year at the Statistical Laboratory at Stanford University.

Jack P. Donis is Treasurer of Lansburgh's, Washington, D. C.

David Durand has assumed duties as Research Associate in the School of Industrial Management, Massachusetts Institute of Technology.

Libert Ehrman, formerly Chief of Safety Analysis in the Office of Aviation Safety, Civil Aeronautics Administration, has resigned from Governmetn service to become an Associate in the firm of Samuel Weiss Research Associates.

Norbert L. Enrick is now Head of the Statistics Department of the Institute of Textile Technology, in Charlottesville, Virginia, where he is concerned with graduate course teaching and analysis of industry sponsored research results.

Lenore Epstein, formerly Reports and Statistics Officer, Foreign Operations Administration, Special Mission to France, has joined the staff of the Social Security Administration to work in the Division of Research and Statistics, Office of the Commissioner, on interprogram benefit studies.

R. K. Flege is now located at Texas Technological College in Lubbock, Texas, where he is head of the Department of Textile Engineering and Associate Director of Cotton Research at Texas Technological College for the Cotton Research Committee of Texas.

John P. Gill has been appointed Director of the Bureau of Business Research, College of Business Administration, University of Georgia.

Alfred Glixman has been appointed Associate Professor of Psychology at the University of Oklahoma. His area of interest is experimental-theoretical psychology.

Amor Gosfield has left the staff of the University of Pennsylvania to accept a position as Associate Professor of Finance with Duquesne University in the School of Business Administration.

W. J. Hall, having returned from a year's study in England as a Fulbright Scholar, completed the Ph.D. requirements in statistics at the University of North Carolina in September and is now a member of the technical staff at the Bell Telephone Laboratories in New York.

Kenneth Harwood, formerly head of the Department of Radio and Television in the University of Alabama, has been appointed Chairman of the Department of Telecommunications in the University of Southern California.

C. Roger Heimlich has accepted a commission in the U. S. Public Health Service as an Epidemic Intelligence Officer with the Communicable Disease Center, Epidemiology Branch, Statistics Section, in Atlanta, Georgia.

Marvin A. Iverson has joined the staff of Adelphi College, Garden City, New York as Assistant Professor of Psychology. He was formerly a research psychologist with the Washington office of the American Institute for Research.

Walter C. Jacob has taken a position as a statistician in the Department of Agronomy, University of Illinois. He will be doing consulting work in experimental design and data analysis, teaching courses in statistics and experimental design, and supervising a computational service.

Julius A. Jahn, formerly Director of the Sociological Research Laboratory of the State College of Washington, is now Research Associate in the Services for the Aging, a project of the Community Services Society, New York City.

Saul Kaplan has transferred from the Kansas City regional office of the Bureau of Public Assistance to the departmental office. His work consists of planning studies and statistical analysis. His current major project is a study of absent fathers in aid to dependent children cases—to what extent they contribute to their families and efforts made to obtain support from them.

Lucy M. Klein has transferred from the Statistical Production Section of United Air Lines in Denver to the company's Industrial Engineering Section, Maintenance Base, at the San Francisco International Airport.

Sheldon Levin has joined the staff of the Personnel Research Branch, Personnel Research and Procedures Division, the Adjutant General's Office, Department of the Army, as Chief of the Machine Statistical Analysis Unit.

Clarence D. Long, who has been spending a year as a member of the Senior Staff, Council of Economic Advisers, has returned to the Johns Hopkins University where he is Professor of Economics, and to the National Bureau of Economic Research where he is a member of the Research Staff. He will continue as consultant to the Council of Economic Advisers during the coming year.

S. E. Martinez is studying mathematical statistics and sampling theories at Chicago University. He has a scholarship which was awarded jointly by the United Nations and the Government of El Salvador.

Albert S. Mincis has accepted the position of Executive Statistician to the Chief Librarian of the Brooklyn Public Library. He will be utilizing census tract data for purposes of community planning. In addition to the duties of this position, Mr. Mincis will continue his present association with the Polytechnic Institute of Brooklyn.

J. E. Morton, who has been with the Program Analysis Office of the National Science Foundation, has returned to the faculty of Cornell University. He will continue as consultant to the Foundation.

Frederick Mosteller, of Harvard University, will be on leave with the Committee on Statistics at the University of Chicago, as visiting Professor of Statistics during the academic year 1954–55. He has been granted a fellowship by the Fund for the Advancement of Education.

Jeanne L. Mosure received the degree of Master of Social Work from Ohio State University in August and is now Research Director for the Community Council of Memphis-Shelby County.

Sidney I. Neuwirth has accepted the position of Director of the Statistics Division at the Mutual Insurance Advisory Association, New York. He was formerly affiliated with the Committee on Research of the American Medical Association in Chicago.

A. E. Nielsen is now teaching at Roanoke College, Salem, Virginia, with the rank of Associate Professor and Acting Head of the Department of Economics and Business Administration.

Monroe L. Norden, a Senior Associate of Dunlap and Associates, Inc., of Stamford, Connecticut, has been appointed an Engineering Statistician in the Statistical Research and Consulting Group of the Research Division of the College of Engineering of New York University, to work on engineering problems which involve the representation of physical processes by stochastic processes.

Boyd Z. Palmer is now employed by the Timken Roller Bearing Company, Canton, Ohio, as a statistician in the Quality Control Department. He was formerly with the American Friends Service Committee, in Chicago.

Sidney Pell is now doing statistical research on a fellowship for the Medical Division of the E. I. du Pont de Nemours Company. The work is part of a cooperative program between the Medical Division and the Department of Biostatistics at the University of Pittsburgh's School of Public Health.

LeRoy Powers, who has been at the Cheyenne Horticultural Field Station, Horticultural Crop Research Branch, Agricultural Research Service, USDA, has been transferred to the Sugar Crops Section of the Field Crop Research Branch. His headquarters are now at Fort Collins, Colorado, where he is Principal Geneticist and in charge of the research work with sugar beets. The work is in cooperation with the Agronomy Department of the Colorado Agricultural and Mechanical College.

Charles K. Ramond, 1st Lt., USA, formerly Acting Chief, Human Research Unit No. 3, Office, Chief of Army Field Forces, Fort Benning, Ga., is now attending The Adjutant General's School, Fort Benjamin Harrison, Ind.

John M. Randolph is now employed by the Curtiss-Wright Corporation as Financial Analyst on the Corporate Controller's staff. His previous position was with the Chesapeake and Ohio Railway Company, in Cleveland, as Operations Analyst.

Stanley Reiter has been appointed Assistant Professor of Economics and Mathematics at Purdue University.

Mary E. Reuder (Mrs. Marvin A. Iverson) has joined the staff of Queens College, Flushing, N. Y. as Instructor in Psychology. She was formerly Research Psychologist with the Personnel Research Branch, The Adjutant General's Office, Department of the Army, in Washington.

Irving Schweiger has received a Rockefeller Foundation Postdoctoral Award in Applied Statistics. He will take a year's leave of absence from the Board of Governors of the Federal Reserve System to pursue a program of study and research at the University of Chicago.

J. C. Sentz has accepted a plant breeding position with the U. S. Department of Agriculture and will be in charge of the soybean breeding program in Minnesota.

Max Shor, formerly in the Economic Statistics Section, Population and Housing Division, Bureau of the Census, has transferred to the Office of the Assistant Chief for Mineral Industries, Industry Division.

Morris Skibinsky, who received his Doctor's degree in August 1954, from the University of North Carolina at Chapel Hill, has been appointed Research Associate in the Statistical Laboratory, Purdue University.

J. R. Steen has been appointed Manager of Quality Control, Sylvania Electric Products, Inc., Woburn, Mass.

William R. Stock is with the Small Motor Division of Westinghouse Electric Corporation at Lima, Ohio, as Quality Control Engineer.

William J. Thomas is Acting Director of Research and Associate Professor of Statistics and Economics, School of Business, Baylor University, Waco, Texas. He was formerly the statistician of the Bureau of Business and Economic Research, College of Business Administration, University of Arkansas.

Morris B. Ullman, Chief of the Statistical Reports Section, Office of the Assistant Director for Statistical Standards, has returned to the Census Bureau on completion of a one-year assignment with the Economic Advisory Staff to the Government of Israel.

David Lee Wallace, formerly Moore Instructor in Mathematics at Massachusetts Institute of Technology, has been appointed Assistant Professor of Statistics in the Committee on Statistics at the University of Chicago.

Robert Stanley Weinberg has joined the staff of the Division of Industrial Cooperation, Massachusetts Institute of Technology. He is presently assigned to the Operations Evaluation Group, Office of the Chief of Naval Operations, Navy Department, in Washington, as an operations research analyst.

Michael T. Wermel, formerly Chief Actuary, U. S. Bureau of Employment Security and since January 1, 1954, Vice President of Woodward and Fondiller, Inc., Consulting Actuaries, is now in charge of West Coast Operations of Woodward & Fondiller, and is located in Los Angeles.

William H. Williams has left the Canadian Defence Research Board to do graduate work at the Statistical Laboratory, Iowa State College.

Calman Winegarden, formerly Chief of the Branch of Manpower Studies, Division of Manpower and Employment Statistics, Bureau of Labor Statistics, has resigned from Government service to enter private industry.

Joseph Zisman, who has been on loan to the Committee on Retirement Policy for Federal Personnel, and more recently to the White House Foreign Affairs Personnel Task Force, has returned to the Division of Research and Statistics, Social Security Administration.

CHAPTER NOTES

ALBANY

On October 3 the third annual chapter picnic was held at the John Boyd Thacher State Park.

At the meeting held October 29, Thomas R. Hancock, Manager—Marketing and Economics Surveys, General Electric Company, presented applications of statistical methods to marketing research in his speech entitled "Where Do We Go From Here?". J. E. Morton, Professor of Statistics, Cornell University was chairman of a panel on the subject "What Place Has Mathematics in Social and Economic Research" at the regular monthly meeting held November 16.

The report of the Ad Hoc Committee on Statistical Standards was discussed at a series of small-group meetings. As a result of these small meetings, a special meeting of the Chapter was to be held November 23 devoted to this subject.

CENTRAL INDIANA

The first fall meeting was held jointly with the Indianapolis Section of the American Society for Quality Control. It included a visit to the Naval Ordnance Plant, Indianapolis, followed by a dinner at Butler University. Dr. William R. Pabst, Jr., Chief Statistician for the Bureau of Ordnance, Navy Department, spoke on "Designing Experiments for Information".

CENTRAL NEW JERSEY

Dr. Churchill Eisenhart, Chief of the Statistical Engineering Laboratory of the National Bureau of Standards, was the speaker at the meeting held on October 19. His subject was "Scales, Scale Readings and Information".

CHICAGO

The first dinner meeting of the 1954–55 year was held on September 16. Frederick Aschman, Executive Director of the Chicago Plan Commission, spoke on "Remaking Chicago". At the dinner meeting on October 28 Louis Levine, Chief of the Division of Reports and Analysis, Bureau of Employment Security, U. S. Department of Labor, discussed "Applications of Employment Security Statistics to Analysis of Economic Conditions".

Joint luncheon meetings with the Chicago Chapter of the American Marketing Association were held on October 7 and November 4. At the first of these the speaker was Thomas Caywood of Caywood-Schiller Associates, whose topic was "Operations Research—What Is It?". Ronald Rufler, Research Manager of Booz Allen & Hamilton, spoke on "Information Theory—Possible Business Application" at the second. A luncheon meeting was also held on October 19, at which Clyde W. Hart, Director of the National Opinion Research Center, discussed "Pre-Election Polls and Forecasts".

CLEVELAND

Cleveland statisticians watched a skit on how to sell statistics to management on September 21st at the first meeting of the Cleveland Chapter in the 1954–1955 season. Louis Rice and David J. Ausmus from the Quality Control Department of the Timken Roller Bearing Company in Canton, Ohio, put on a demonstration of various gadgets used to lead management to an appreciation of statistics. Mr. Rice took the part of a quality control director trying to sell his plant manager—Mr. Ausmus—on the efficiency of statistics for manufacturing process inspection. Using a combination of slides and demonstration devices, Mr. Rice explained to his doubting plant manager the inherent variation in machine processes, the detection of improper machine settings with control charts, the efficiency of sampling plans for receiving inspection, and the calculation of the tolerance of a completed assembly from the random combination of varying sub-assemblies.

At the luncheon meeting on October 26, Robert L. Brickley from Westinghouse Electric Corporation in Pittsburgh spoke on the subject: "A Statistical Approach to Problems in Research and Development". Mr. Brickley took a typical research problem as presented by Westinghouse engineers and described the steps taken to solve the problem using statistical analysis. He illustrated his procedure by showing how an efficient experiment was designed to select an annealing practice which would provide the optimum magnetic characteristics of motor-grade steels. Using the suggestions of their engineers as a guide, Westinghouse statisticians carried out an efficient experimental design involving fractional replication with a split-plot arrangement.

DENVER

The Denver Chapter has made plans for holding a meeting on the second Thursday of each month from September 1954 to June 1955. Six of these are to be dinner meetings at which topics of general interest will be discussed; the other four will be informal workshops or seminar meetings devoted to the application of statistics in specific fields of activity. In an effort to boost attendance an experiment is being tried of calling members in Denver to find out whether they are coming to the meeting each month.

At the first of the dinner meetings, held on September 9, Palmer L. Burch, Chairman of the Finance Committee of the Colorado House of Representatives and Chairman of the Legislative Council, discussed "The State Constitutional Amendments on the 1954 Ballot". The first workshop meeting was held on October 14. Dr. Byron Johnson, Associate Professor of Economics at the University of Denver, and Carl Nordguist, Assistant Professor of Economics at the Colorado School of Mines, described their method of estimating income payments by counties in Colorado.

HAWAII

The speaker at the dinner meeting held on September 20 was Cecil Hastings. Mr. Hastings described the RANDom Digit Generator built by RAND, discussed the use of random numbers in experimental probability calculations, and told of some of the difficulties to be encountered in producing a truly random sequence of digits.

LOS ANGELES

The first dinner meeting of the 1954–55 year was held on September 30. Dr. Edward P. Coleman, Professor of Engineering at the University of California at Los Angeles, spoke on "Some Fundamental Concepts in the Industrial Application of Statistics". At the dinner meeting on October 28 Harry L. Nolder, Regional Supervisor of the Bureau of the Census, described the work of the Intensive Review Committee (Watkins Committee) appointed by the Secretary of Commerce to review Census programs, and discussed the action taken to date on the Committee's recommendations.

Michigan University,
General Library,
Ann Harbor, Michigan. A/S
FWF

NEW VIRGINIA ACADEMY OF SCIENCE CHAPTER

The Board of Directors recently granted a charter to the Statistics Section of the Virginia Academy of Science, which had petitioned for affiliation as a chapter. W. S. Connor, who had been elected as Chairman of the Section and first President of the new chapter has moved to New Jersey. M. C. K. Tweedie of the Department of Statistics, Virginia Polytechnic Institute, who had been Vice-Chairman, will replace Dr. Connor as President. C. Y. Kramer, also of the V.P.I. Department of Statistics, will act as Secretary-Treasurer. Interested ASA members should contact Mr. Kramer for information regarding meetings and other activities of the chapter.

NEW YORK

At the June election Robert R. Behlow, Regional Director of the Bureau of Labor Statistics, was re-elected Vice-President. Virginia Holran of the Institute for Life Insurance, was re-elected Treasurer for a two-year term. Ralph C. Hawkins was elected to the Executive Committee. Mr. Behlow is Acting President in the absence of Meredith Givens, who is in the Philippines on a U. N. mission to centralize and improve Philippine statistics.

The meeting on October 14 was devoted to a discussion of the business outlook. The speakers and their subjects were as follows: Albert Simmers, National Industrial Conference Board—the industrial outlook; George Smith, F. W. Dodge Corporation—the construction outlook; Emile Benoit-Smullyan, McGraw-Hill Economics Department—the foreign trade outlook; Louis Paradiso, Department of Commerce—the consumers outlook; Brooke Willis, Chase National Bank—the financial outlook.

The subject of the October 27 meeting was "Evaluation of Federal Employment and Unemployment Statistics". The speakers included Professor Frederick F. Stephan, Princeton University; Lazare Teper, International Ladies' Garment Workers; Lester Frankel, Alfred Politz Research, Inc.; and Charles Stewart, U. S. Bureau of Labor Statistics. At the November 4 meeting Paul Densen and Neva R. Deardorff of the Health Insurance Plan of Greater New York spoke on "Some Preliminary Findings on Health and Medical Care from the Household Survey of the H.I.P. Special Research Project".

NORTH CAROLINA

New officers for the year 1954–55 are as follows:

President, DR. R. H. BOSE, Institute of Statistics, University of North Carolina.

Vice-President, DR. A. M. JORDON, University of North Carolina.

Secretary-Treasurer, DR. B. F. CURRY, School of Business Administration, University of North Carolina.

ST. LOUIS

A luncheon meeting was held on September 22 at which Guy S. Freutel, Research Associate in the Economics Department of Washington University and Consultant to the Federal Reserve Bank of St. Louis, discussed the question, "Can Urban Redevelopment 'Pay Off' for St. Louis?". At the luncheon meeting of October 13 Lillian Green, Executive Assistant to the President of the Granite City Steel Company, spoke on "Steel—This Year and Next", analyzing the production trend and inventories and forecasting trends for 1955.

A group of statisticians, economists and market analysts interested in forecasting problems has organized and plans regular meetings. Under the chairmanship of George Coleman, Economist, Mercantile Trust Company, this group has become a Section of the St. Louis Chapter, A.S.A.

WASHINGTON

The first meeting of the 1954–55 year, held October 18, was a joint session with the Washington Chapter of the American Association for Public Opinion Research. The subject was "Forecasting the 1954 Election", with Louis H. Bean the principal speaker, and Floyd McCaffree, Director of Research of the Republican National Committee, and Philip M. Stern, Director of Research of the Democratic National Committee, discussants. The chairman of the meeting was Stuart A. Rice, Assistant Director for Statistical Standards, Bureau of the Budget.

The Chapter is sponsoring a series of meetings on Operation Research, emphasizing the use of an analytical framework or model to define the characteristics of required data, surveys and reporting systems. The series was arranged by Ezra Glaser, assisted by Frank Hoeber and David Rosenblatt. The program for the meetings is as follows:

October 25—*Chairman:* Harry Alpert, National Science Foundation. *Speaker:* C. W. Churchman, Case Institute of Technology, "The Relation of Models and Data to Operations Research". *Discussant:* H. Burke Horton, Office of Defense Mobilization.

November 1—*Chairman:* Franz Alt, National Bureau of Standards. *Speaker:* W. W. Cooper, Carnegie Institute of Technology, Linear Programming and the Treatment of Statistical Data". *Discussant:* Walter Jacobs, Department of the Air Force.

November 8—*Chairman:* Karl Fox, Council of Economic Advisors. *Speaker:* Gifford H. Symonds, Esso Standard Oil Company, "Programming Applications in a Context of Competitive Strategy". *Discussant:* Max Woodbury, Logistics Research Project, George Washington University.

November 15—*Chairman:* Harold Barnett, Rand Corporation. *Speaker:* Francis Hoebner, Operations Research Office, Johns Hopkins University, "Costing for Military Effectiveness Models". *Discussant:* Bruce Hanchett, Council for Economic & Industry Research.

November 29—*Chairman:* Morris H. Hansen, Bureau of the Census. *Speaker:* Richard M. Cyert, Carnegie Institute of Technology, "Sampling Theory in Relation to Auditing Models of Internal Control". *Discussant:* Dorothy Gilford, Federal Trade Commission.

December 6—SUMMARY AND EVALUATION. *Chairman:* Ezra Glaser, Bureau of the Budget. *Discussants:* R. Boyd Ladd, Operations Research Office, Johns Hopkins University; David Rosenblatt, American University.

At the October meeting amendments to the constitution were adopted providing that voting in elections shall be by mail ballot sent to all members, rather than by those present at the annual meeting, and also providing for election of members of the Executive Committee as well as of officers.